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SOUTH SASKATCHEWAN RIVER
DEVELOPMENT COMMISSION



SOUTH SASKATCHEWAN RIVER DEVELOPMENT PROJECT

1961

1350

MINISTER OF AGRICULTURE AND RURAL DEVELOPMENT

MINISTER

Mr. E. C. Douglas

SOUTH SASKATCHEWAN RIVER DEVELOPMENT PROJECT

PROGRESS REPORT FOR 1961

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South Saskatchewan River Development Commission

Legislative Building
Regina, Saskatchewan

to November 7, 1961

from November 7, 1961

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SOUTH SASKATCHEWAN RIVER DEVELOPMENT COMMISSION

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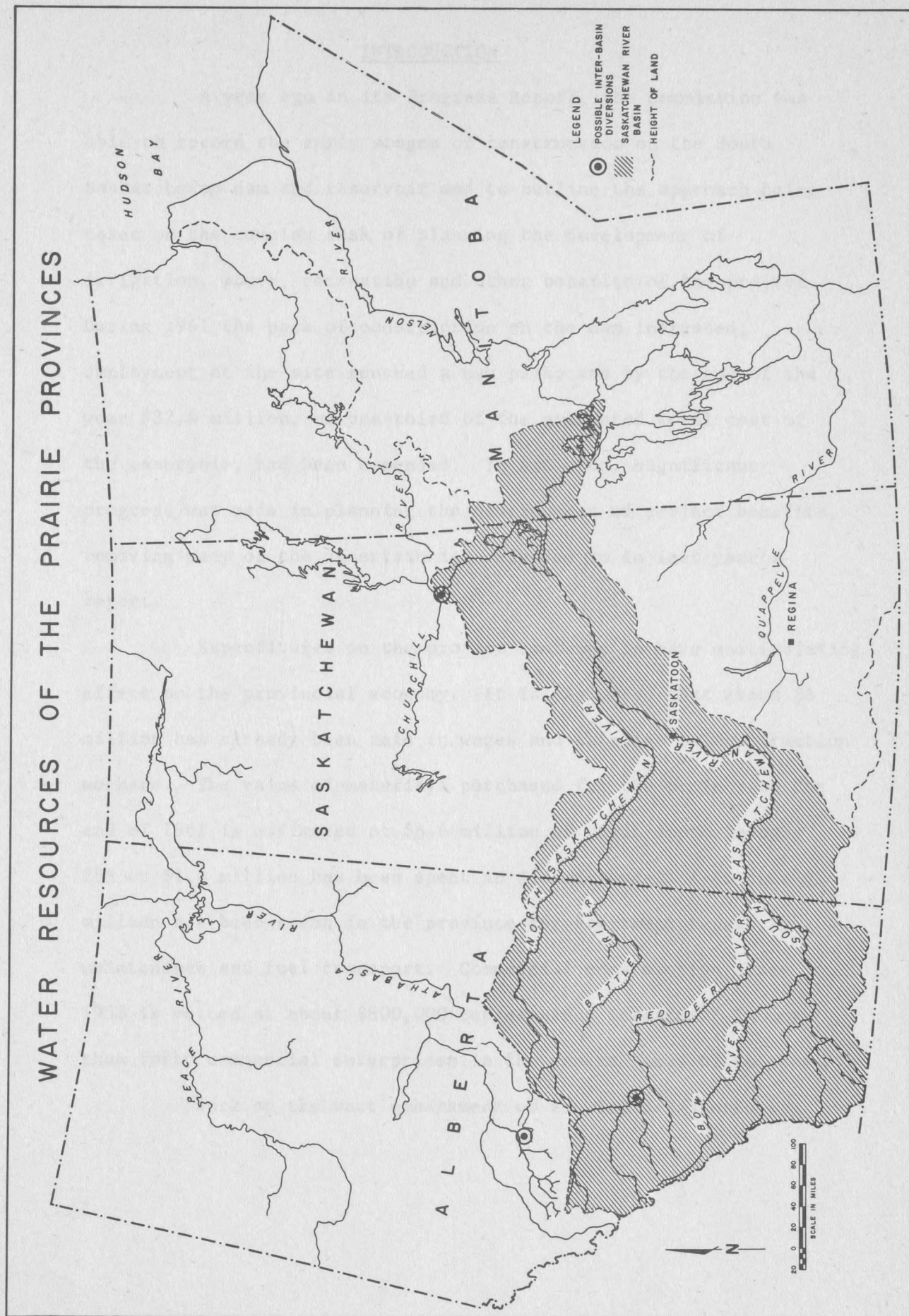
PREFACE

This, the second in a series of progress reports, has been prepared by the South Saskatchewan River Development Commission to serve as a summary of work to date on the construction of the South Saskatchewan reservoir, and of progress in the complex task of planning the multiple benefits that will result from the creation of this new water resource in west-central Saskatchewan.

The report contains an outline of construction and planning work undertaken during 1961 on the reservoir, irrigation, power, recreation and other phases of the project. Some of the more immediate effects of this work on economic activity in the province are discussed.

The project is creating considerable interest among people in many walks of life, in Saskatchewan, throughout Canada and in other countries. It is hoped that this report will prove to be a useful source of current information on the project.

WATER RESOURCES OF THE PRAIRIE PROVINCES



INTRODUCTION

A year ago in its Progress Report, the Commission was able to record the early stages of construction on the South Saskatchewan dam and reservoir and to outline the approach being taken on the complex task of planning the development of irrigation, power, recreation and other benefits of the project. During 1961 the pace of construction on the dam increased; employment at the site reached a new peak; and by the end of the year \$32.6 million, or one-third of the estimated total cost of the reservoir, had been expended. In addition, significant progress was made in planning the development of project benefits, removing many of the uncertainties referred to in last year's report.

Expenditures on the project continue to have a stimulating effect on the provincial economy. It is estimated that about \$6 million has already been paid in wages and salaries to construction workers. The value of materials purchased for the project to the end of 1961 is estimated at \$6.6 million of which approximately 25% or \$1.6 million has been spent in Saskatchewan. A further \$5 million has been spent in the province for equipment repair, maintenance and fuel transport. Commercial construction since 1958 is valued at about \$800,000 representing investment in more than forty commercial enterprises in the general area of the dam.

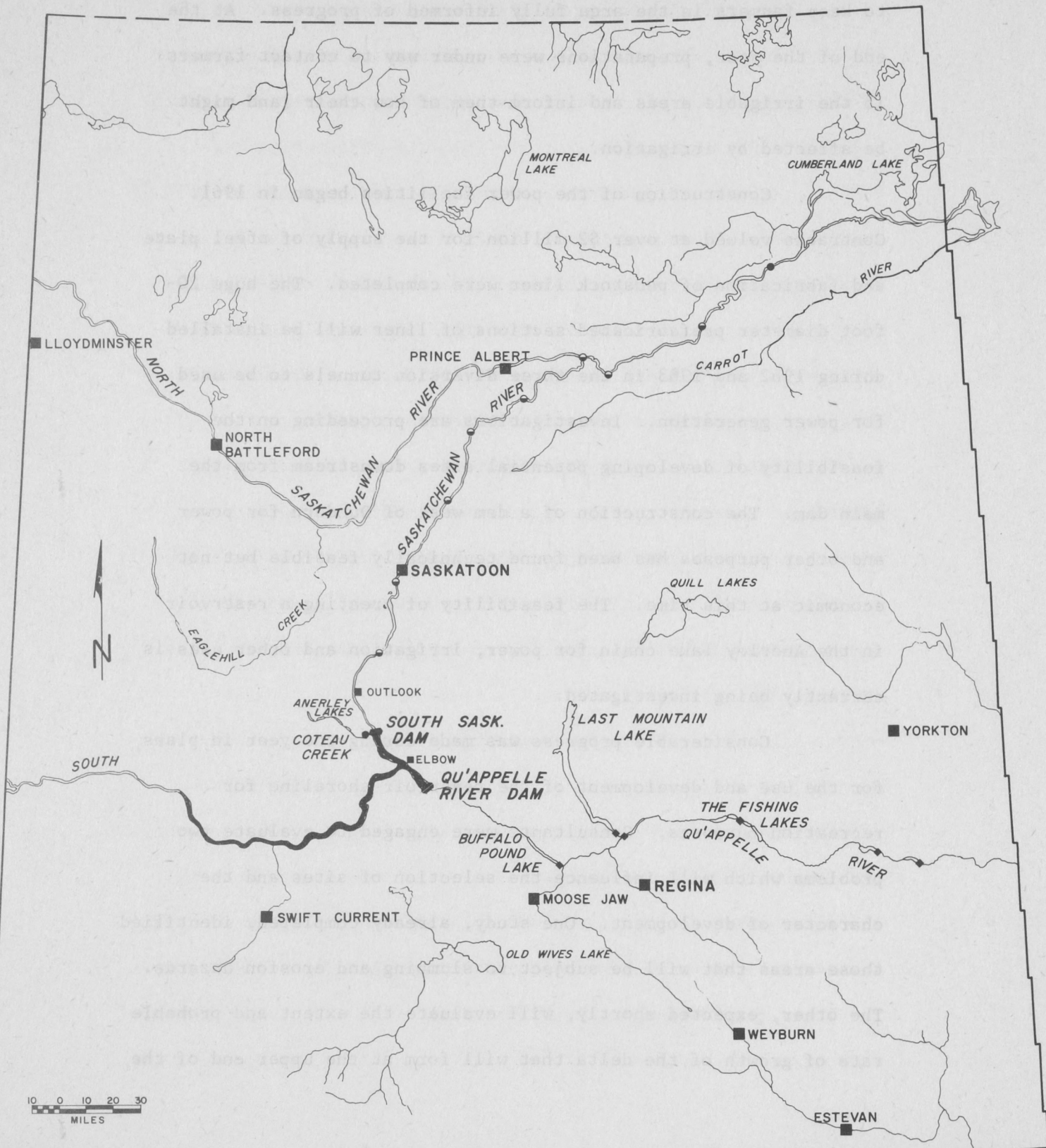
Work on the west embankment of the South Saskatchewan

to keep farmers in the area fully informed of progress. At the end of the year, preparations were under way to contact farmers in the irrigable areas and inform them of how their land might be affected by irrigation.

Construction of the power facilities began in 1961. Contracts valued at over \$2 million for the supply of steel plate and fabrication of penstock liner were completed. The huge 20-foot diameter prefabricated sections of liner will be installed during 1962 and 1963 in the three diversion tunnels to be used for power generation. Investigations are proceeding on the feasibility of developing potential sites downstream from the main dam. The construction of a dam west of Dundurn for power and other purposes has been found technically feasible but not economic at this time. The feasibility of creating a reservoir in the Anerley lake chain for power, irrigation and other uses is currently being investigated.

Considerable progress was made during the year in plans for the use and development of the reservoir shoreline for recreation purposes. Consultants were engaged to evaluate two problems which will influence the selection of sites and the character of development. One study, already completed, identified those areas that will be subject to slumping and erosion hazards. The other, expected shortly, will evaluate the extent and probable rate of growth of the delta that will form at the upper end of the

LOCATION MAP



reservoir due to deposition of river-borne sediment.

The first regulations to guide the orderly development of shoreline property for agricultural, recreational, commercial and other uses were introduced in 1961. In June the Commission introduced land use controls around the site of the South Saskatchewan dam. During 1962, the Commission expects to extend these regulations over the balance of the reservoir shoreline, including the area around the site of the Qu'Appelle dam. At first, the plan associated with the regulations will be fairly general but it will be revised in stages as studies on the physical characteristics of the shoreline are completed and as land requirements for each type of use become apparent.

Through the work of planning and development described in this report, the available water resources of the South Saskatchewan River will be harnessed to serve man's needs. The flow of the river will be controlled, land will be irrigated, power will be generated, the recreation potential of the reservoir developed, and water will be made available for industrial and other consumptive uses. Through careful planning, development and operation, the South Saskatchewan reservoir will become a tremendously valuable addition to the resources of Saskatchewan and will add immeasurably to the wealth and prosperity of the people of the province.

PROJECT AGREEMENT AND ADMINISTRATION

The governments of Canada and Saskatchewan reached agreement July 25, 1958, on the integrated planning, construction and financing of the multi-purpose South Saskatchewan project. All construction and planning activity is proceeding within the framework of this agreement.

In broad terms, Canada is responsible for the design and construction of the reservoir with its two earth dams, for certain related works and for the acquisition of lands in the area of flooding. Saskatchewan is primarily responsible for planning, developing and financing the various benefits of the project; irrigation, power, recreation and secondary benefits.

Although Canada is charged with construction of the reservoir, Saskatchewan will assist in certain associated tasks, such as the relocation of highways and other public services and the transfer of leased land. Canada will contribute a proportion of the cost of outlet works which will pump water from the reservoir to the irrigation canals, and Saskatchewan will construct and finance the rest of the irrigation system. Since some of the power will be used to pump irrigation water, Canada will also contribute 25% of the cost of penstocks. Saskatchewan will construct and finance the power house and generating facilities.

On completion of the reservoir, title to all lands and structures will be transferred to Saskatchewan. The province

will then assume responsibility for reservoir operation, including the allocation of water to project beneficiaries. Responsibility for maintenance will rest with Canada for ten years after the completion date. Cost of maintenance will be paid by Canada for the first six of these ten years and shared equally with Saskatchewan during the last four.

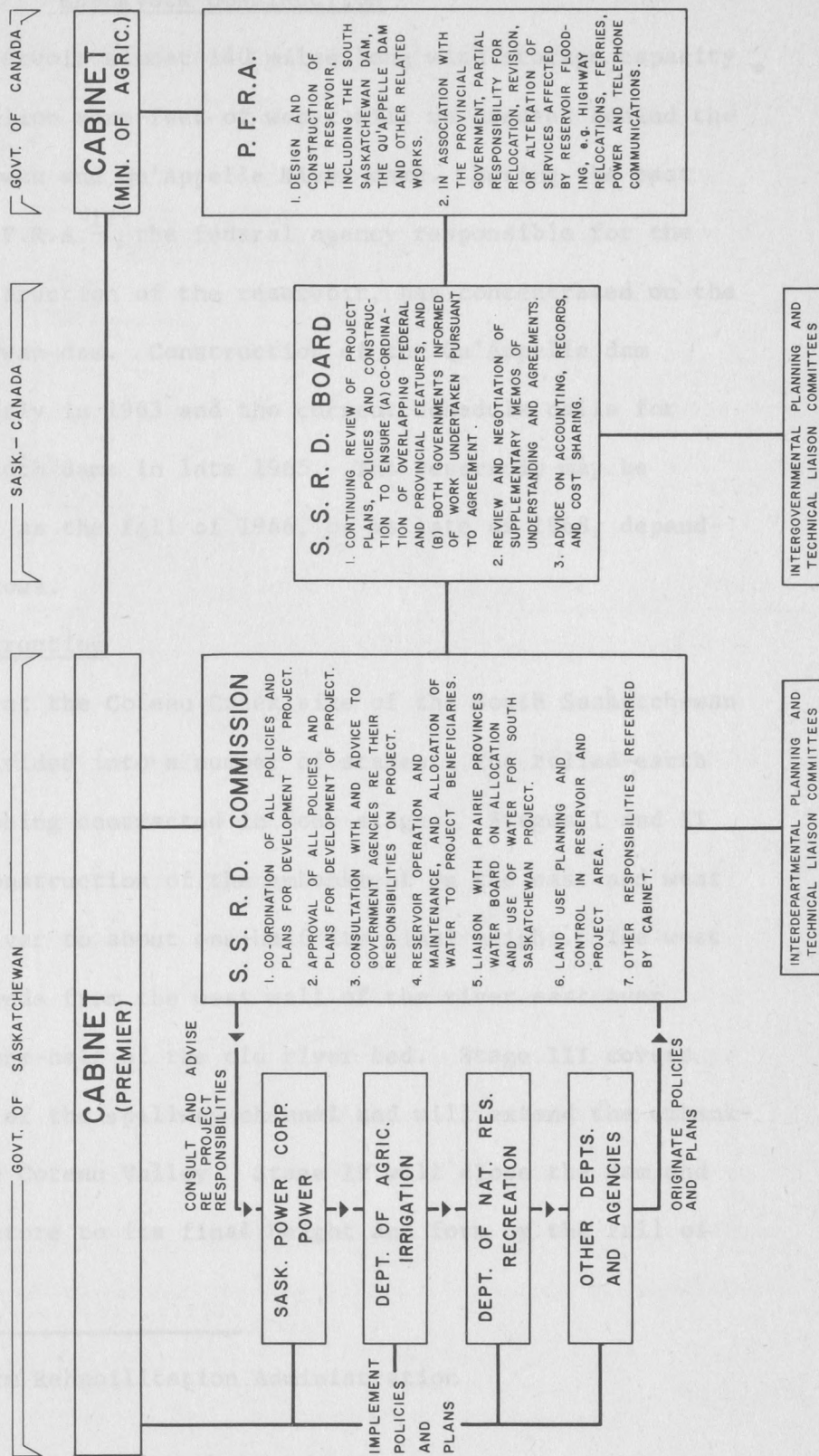
Cost of the dams and other works associated with creating the reservoir is currently estimated at \$96 million, of which Canada will contribute 75% or \$72 million and Saskatchewan 25% or \$24 million. One-half of Saskatchewan's contribution may be in cash and one-half in 20-year bonds.

The various benefits will likely be developed over several decades and costs are difficult to estimate. The first stage of power works will cost an estimated \$29 million including about \$6 million for the penstocks; the second stage may cost \$21 million. Irrigation development may ultimately cost \$50 million and public investment in recreation facilities may reach \$10 to \$15 million.

Administration

Shortly after the 1958 Agreement was signed, an administrative organization was established to plan and develop the multiple phases of the project and to co-ordinate, between provincial agencies and between the provincial and federal governments. The general framework of the organization is shown in the following chart.

SOUTH SASKATCHEWAN RIVER DEVELOPMENT PROJECT ORGANIZATION CHART



RESERVOIR CONSTRUCTION

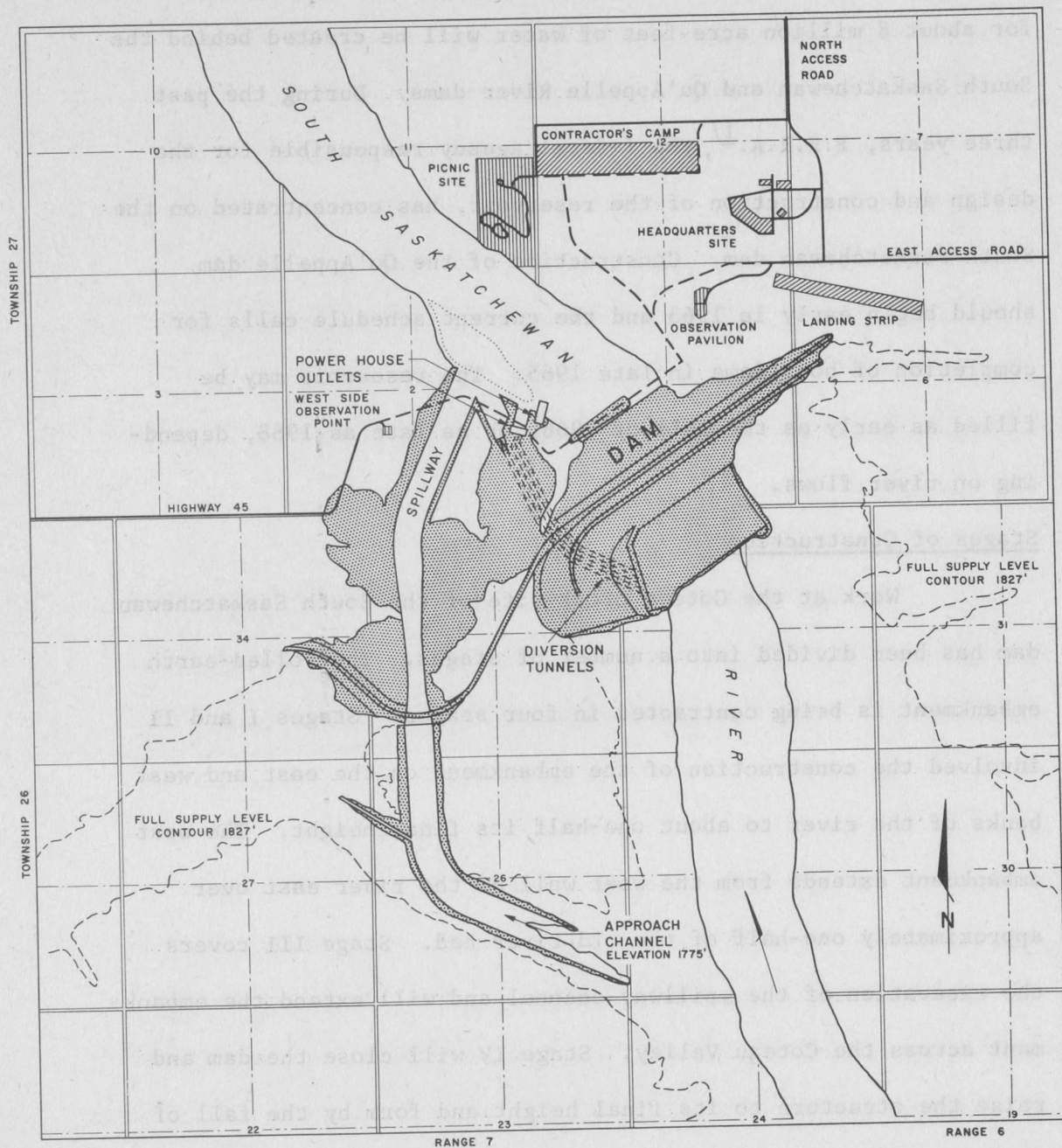
A reservoir almost 140 miles long with storage capacity for about 8 million acre-feet of water will be created behind the South Saskatchewan and Qu'Appelle River dams. During the past three years, P.F.R.A.^{1/}, the federal agency responsible for the design and construction of the reservoir, has concentrated on the South Saskatchewan dam. Construction of the Qu'Appelle dam should begin early in 1963 and the current schedule calls for completion of both dams in late 1965. The reservoir may be filled as early as the fall of 1966, or as late as 1968, depending on river flows.

Stages of Construction

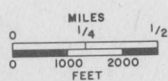
Work at the Coteau Creek site of the South Saskatchewan dam has been divided into a number of stages. The rolled-earth embankment is being contracted in four stages. Stages I and II involved the construction of the embankment on the east and west banks of the river to about one-half its final height. The west embankment extends from the west wall of the river east over approximately one-half of the old river bed. Stage III covers the excavation of the spillway channel and will extend the embankment across the Coteau Valley. Stage IV will close the dam and raise the structure to its final height and form by the fall of 1965.

^{1/} Prairie Farm Rehabilitation Administration

SOUTH SASKATCHEWAN DAM



LEGEND



- EXTENT OF EARTH FILL DAM
- PUBLIC ACCESS AREAS
- OTHER BUILDINGS, PUBLIC ACCESS RESTRICTED

- ROADS, UNRESTRICTED
- CONSTRUCTION ROADS, PUBLIC ACCESS RESTRICTED
- ROAD ALLOWANCES

During the first three stages, the river is being confined to an 800-foot wide channel on the east side. Five 25-foot diameter tunnels, 4,000 feet long, are being mined through the west embankment. These tunnels should be completed early in 1963. Work will then be concentrated on preparations for the closure of the river channel in August and diversion of the flow through the tunnels. This is a critical date. An August flood -- not unknown in the past -- could postpone diversion and thus the construction schedule by an entire year.

Progress of Construction

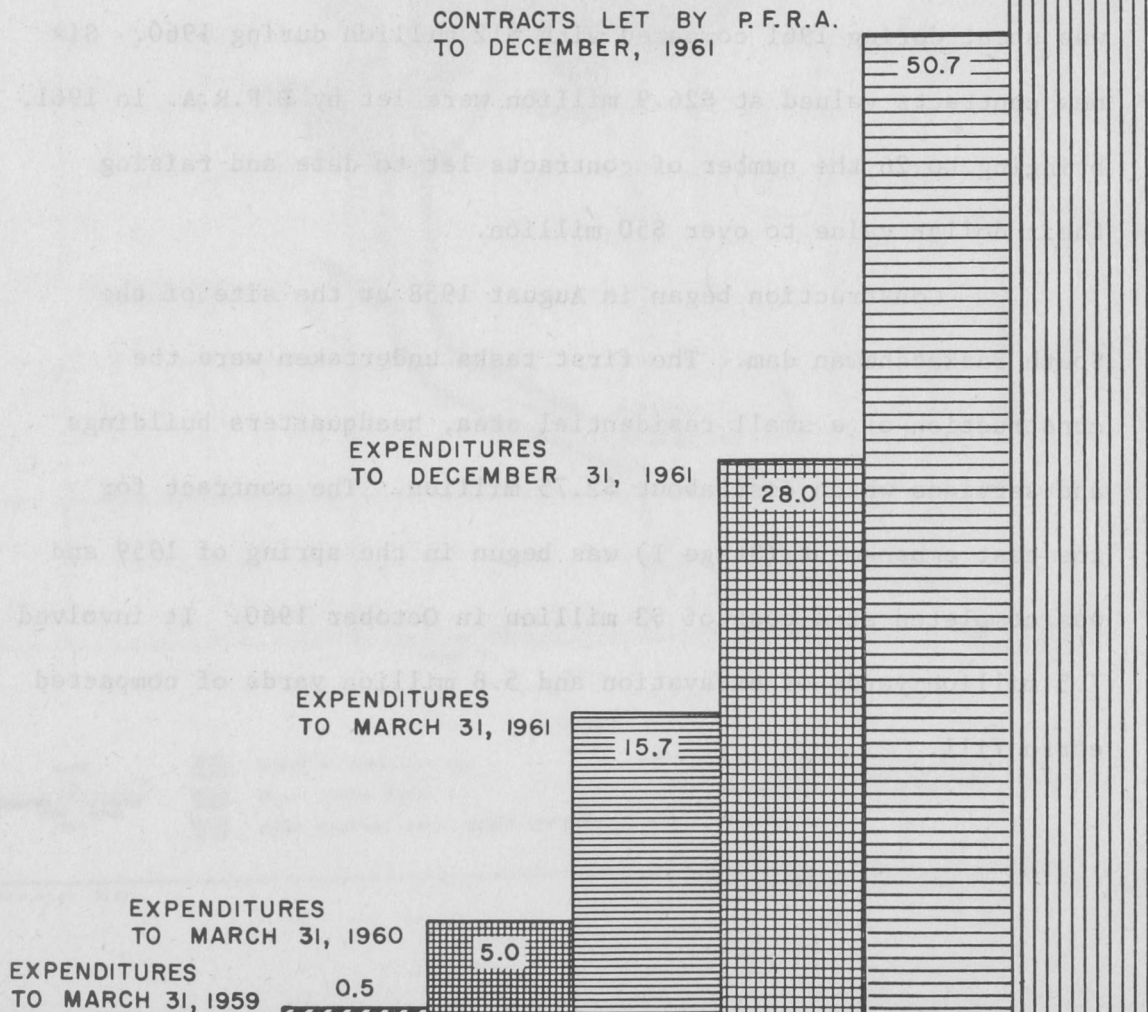
Work has proceeded generally to schedule and expenditures had reached \$32.6 million by the end of 1961. About \$15 million was spent during 1961 compared with \$12 million during 1960. Six new contracts valued at \$26.9 million were let by P.F.R.A. in 1961, bringing to 26 the number of contracts let to date and raising their dollar value to over \$50 million.

Construction began in August 1958 at the site of the South Saskatchewan dam. The first tasks undertaken were the construction of a small residential area, headquarters buildings and services which cost about \$2.75 million. The contract for the east embankment (Stage I) was begun in the spring of 1959 and was completed at a cost of \$3 million in October 1960. It involved 7.5 million yards of excavation and 5.8 million yards of compacted earth fill.

SHAREABLE EXPENDITURES ON RESERVOIR CONSTRUCTION (MILLIONS OF DOLLARS)

COSTS SHAREABLE

BY CANADA 75%
BY SASKATCHEWAN 25%



Work on the west embankment (Stage II) began in July of 1959 and was completed on schedule in October 1961. The contract included 18 million yards of excavation and 14 million yards of compacted embankment at a total cost of about \$7 million. A small associated contract for relief wells and drainage has also been completed.

The contract for Stage III of the embankment was let during the summer of 1961, at a value of more than \$8 million. Progress has been excellent to date and the contract may be completed ahead of schedule, late in 1962 or early in 1963.

Work on the downstream portion of the diversion tunnels was started in 1960 advanced during the summer of 1961, and is continuing through the winter. This work is scheduled for completion by December 31, 1962 at a cost of about \$8 million. It involves excavating the five tunnels, lining each with reinforced concrete and installing a steel liner in the three riverward tunnels. Early in the year there was some difficulty with the "mole" used for tunnelling but this has been overcome and will not cause a delay in completion of the dam.

A contract for construction of the upstream portion of the tunnels was let in April of 1961. Work to be completed under this contract includes the excavation of about 10,000 feet of tunnel and the construction of both low-level diversion inlets and high-level power inlets. This work began in April

1961, and is scheduled for completion in the summer of 1963. The contract is valued at more than \$8.5 million.

The other large contract let during the year was for the construction of the five vertical control shafts. These shafts, to be excavated through the centre of the dam, will connect with the diversion tunnels. The contract was awarded for \$5 million and work started late in 1961. Gates and other works to control the flow of water through the tunnels will be installed in the shafts under a contract to be let next year.

The Qu'Appelle River Dam and Other Works

Preliminary survey work to determine the exact location of the Qu'Appelle dam is currently under way. Construction will probably begin early in 1963, with completion scheduled for 1965. The dam will be 90 feet in height, 9,000 feet in length and about 700 feet wide at the base.

Several highway relocations have been completed or contracted under the terms of a special "Memorandum of Understanding" between the federal and provincial governments. Highway No. 45 between Birsay and Elbow has been relocated along a new route from Birsay north to Tichfield. When the project is completed, it will connect with a road over the dam. Next year it will be extended north past Macrorie to intersect with No. 15 just west of the South Saskatchewan river. Highway No. 19 south of Elbow has been relocated southeast around the site of the Qu'Appelle

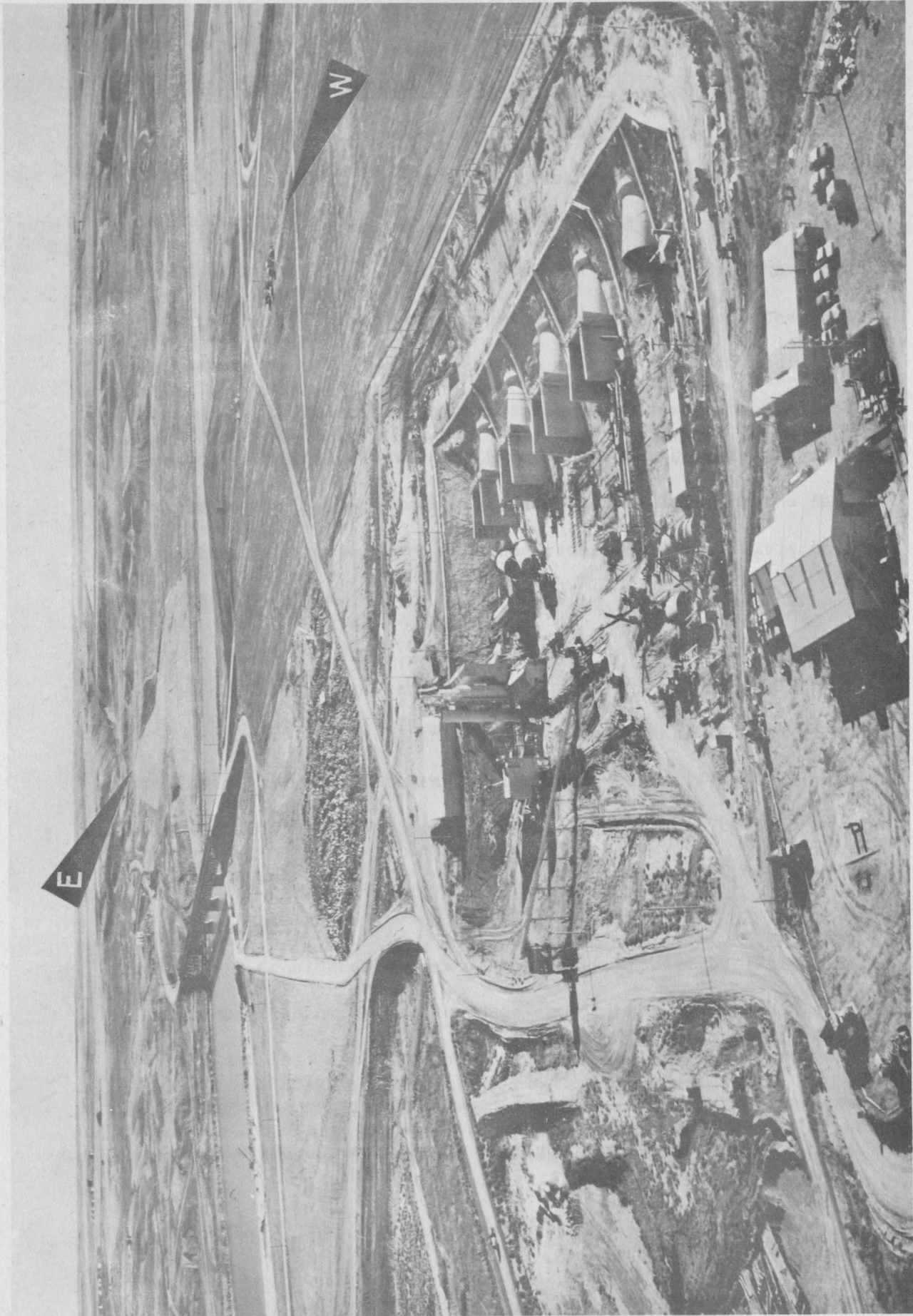
dam and south to No. 42.

The 1958 Agreement on the project called for the later negotiation of a special agreement to cover the revision and relocation of all public services that will be flooded or otherwise affected by the reservoir, including highways, roads, bridges, ferries, power and telephone lines. This agreement should be finalized some time in 1962.



PFRA Photograph

SOUTH SASKATCHEWAN DAM, SHOWING EAST & WEST EMBANKMENTS,
DIVERSION TUNNEL PORTALS, UPSTREAM, U, DOWNSTREAM, D,
HIGH LEVEL INLETS, H.



PFRA Photograph

VIEW OF DOWNSTREAM TUNNEL PORTALS SHOWING CONSTRUCTION BRIDGE,
EAST EMBANKMENT E, AND WEST EMBANKMENT W.

IRRIGATION DEVELOPMENT

During the past year, work has pressed forward on a number of studies to delineate the land most suitable for irrigation and to determine the best method of serving these areas with water. In addition, several other studies have been undertaken to explore the economics of irrigation and the various components of a land and irrigation policy. The provincial Department of Agriculture has been assisted in this work by staff of the Saskatchewan Soils Survey and Farm Management Departments of the University of Saskatchewan, the Economics Division of the federal Department of Agriculture, and the federal Drainage Division at Vauxhall, Alberta.

Under the current scheduling of reservoir construction it is not anticipated that irrigation will start until 1968 at the earliest. Prior to this three to four years will be required to design and construct the irrigation system. With this in mind the areas to be served first should be determined by 1963 or 1964 at the latest.

Physical Studies

Considerable work was undertaken prior to 1961 to determine the properties of soils, drainage conditions, topographic characteristics and land use throughout the area thought to be irrigable. This work was continued during 1961. The Soils Survey has now covered 2,586,000 acres; the Drainage Division has taken 3,000

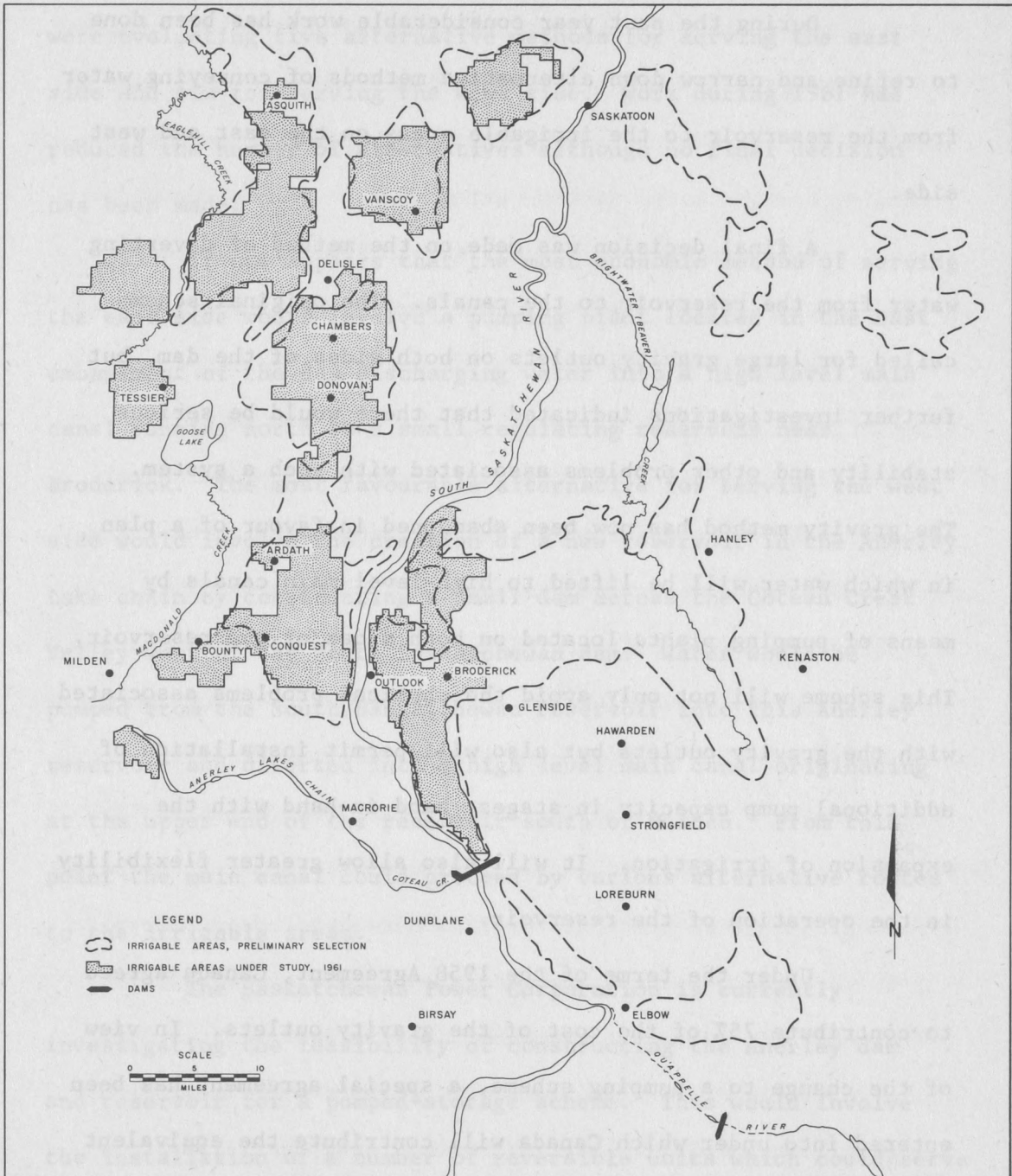
to an average depth of 10 - 12 feet and analyzed over 30,000 samples; and the provincial Department of Agriculture has obtained topographic data on 620,000 acres.

Based upon experience in Alberta and the United States a preliminary land classification procedure has been developed. The soil and topographic information is analyzed and mapped. These and other factors are then integrated to give an overall classification for each parcel of land. This classification reflects costs of land development, operation costs and expected productivity under irrigation.

Preliminary results of this work indicate that three main blocks can be developed, one on the east side and two on the west side of the river. These are shown on the map on the next page. In addition, there are other smaller areas which can be developed and some of these will be serviced independently of the main systems. The block on the east side is located in the Outlook-Broderick area and contains a total of about 38,000 acres. The most desirable west side blocks are located in the Conquest-Donovan and Vanscoy-Asquith areas. These areas contain a total of about 180,000 acres. It should be noted that these figures indicate the acreages which can be serviced. The net acreage suited to gravity irrigation will be considerably less, due to topography, land occupied by homesteads and canals and other reasons. The net irrigable acreage in these blocks

IRRIGABLE AREAS

SOUTH SASKATCHEWAN RIVER DEVELOPMENT PROJECT



will not be known exactly until the design of the system to serve the land and other work is completed.

System Design

During the past year considerable work has been done to refine and narrow down alternative methods of conveying water from the reservoir to the irrigable areas on the east and west side.

A final decision was made on the method of diverting water from the reservoir to the canals. The original scheme called for large gravity outlets on both sides of the dam, but further investigations indicated that there would be serious stability and other problems associated with such a system. The gravity method has now been abandoned in favour of a plan in which water will be lifted to high-level main canals by means of pumping plants located on both sides of the reservoir. This scheme will not only avoid the physical problems associated with the gravity outlets but also will permit installation of additional pump capacity in stages, hand-in-hand with the expansion of irrigation. It will also allow greater flexibility in the operation of the reservoir.

Under the terms of the 1958 Agreement, Canada agreed to contribute 75% of the cost of the gravity outlets. In view of the change to a pumping scheme, a special agreement has been entered into under which Canada will contribute the equivalent

of 75% of the estimated cost of the gravity outlets toward the cost of pump installations.

A year ago the department's engineers had selected and were evaluating five alternative methods for serving the east side and six for serving the west side. Work during 1961 has reduced the number of alternatives although no final decision has been made.

It now appears that the most economic method of serving the east side would involve a pumping plant located in the east embankment of the dam discharging water into a high level main canal running north to a small regulating reservoir near Broderick. The most favourable alternative for serving the west side would involve the creation of a new reservoir in the Anerley Lake chain by constructing a small dam across the Coteau Creek Valley west of the South Saskatchewan dam. Water would be pumped from the South Saskatchewan reservoir into this Anerley reservoir and diverted into a high level main canal originating at the upper end of the reservoir south of Mildren. From this point the main canal could proceed by various alternative routes to the irrigable areas.

The Saskatchewan Power Corporation is currently investigating the feasibility of constructing the Anerley dam and reservoir for a pumped-storage scheme. This would involve the installation of a number of reversible units which could serve

either as pumps or turbines and which could be powered from thermal or hydro energy sources when serving as pumps. During off-peak periods, water could be pumped from the South Saskatchewan reservoir into the Anerley reservoir using low-cost off-peak power. It could later be returned to the South Saskatchewan reservoir through the same units serving as turbines providing energy to the system during periods of high demand. If this scheme proves feasible and the initial irrigation development is on the west side, the power and irrigation plans will be closely co-ordinated.

Economics and Policy

The success of an irrigation project depends on more than suitable soils and a sound engineering scheme. These are basic. But, more important, is the adoption of sound land, irrigation and other policies designed to encourage and sustain the optimum development and use of the various resources involved.

With this in mind, the department is undertaking a large number of studies on the economics of irrigation and the various components of a land and irrigation policy. It is being assisted in this by staff of the Farm Management Department of the University of Saskatchewan and the provincial departments of Industry and Information and Municipal Affairs.

These studies will serve to guide the formulation of policies respecting such matters as land acquisition; rate of

irrigation development; credit requirements for land, land development, machinery and other purposes; and the framework and responsibilities of a local irrigation district. They will indicate the market and income potential for specialty crops, the income potential of various sizes of farm units under various combinations of land use and production, and the capital and other requirements of irrigation farmers.

Extension Program

While work on the soils, engineering, economics and policy investigations proceed, the department is taking every opportunity to keep the farmers concerned fully informed of progress. A number of local study groups were formed prior to 1961 to exchange information and views. From these groups, a Central Farm Irrigation Policy Committee was set up with two representatives from each study group. During the past summer, members of this committee toured irrigation developments in Alberta to see first hand some of the benefits and problems of irrigation farming.

The department is currently preparing to contact farmers in the areas most suitable for initial development to inform them of how their land might be affected by irrigation. In certain areas, tentative field layouts have been mapped for each quarter section. The maps show the possible location of canals and service and drainage ditches. They will be mailed to the

farmers concerned early in 1962 with an invitation to visit the district office of the Agricultural Representative in Outlook to obtain a detailed explanation of the plans and to discuss any other questions concerning irrigation.

POWER DEVELOPMENT

The 1958 decision to proceed with construction of the South Saskatchewan reservoir meant that within a decade the flow of the south branch of the Saskatchewan River would be under almost perfect regulation. Not only would this make possible the construction of a large hydro facility at the site of the South Saskatchewan dam itself, but it soon became apparent that it would improve the economics of developing additional sites downstream between the dam and Squaw Rapids for hydro and other purposes. The huge capacity of the reservoir would make it possible to store peak flows in the south branch during the spring and summer and to release this water during the winter when the flow in the main stem is low and the demand for power is high.

This prospect, coupled with the rapidly expanding power requirements of the province, led to immediate investigations by the Saskatchewan Power Corporation to determine the most economic design of the power development at the South Saskatchewan dam. It has also stimulated preliminary investigations of the feasibility, cost and possible sequence of developing additional sites downstream from the dam.

The Coteau Creek Hydro Development - South Saskatchewan Dam

Following investigations early in 1960, it was decided that the power installations at the South Saskatchewan dam would

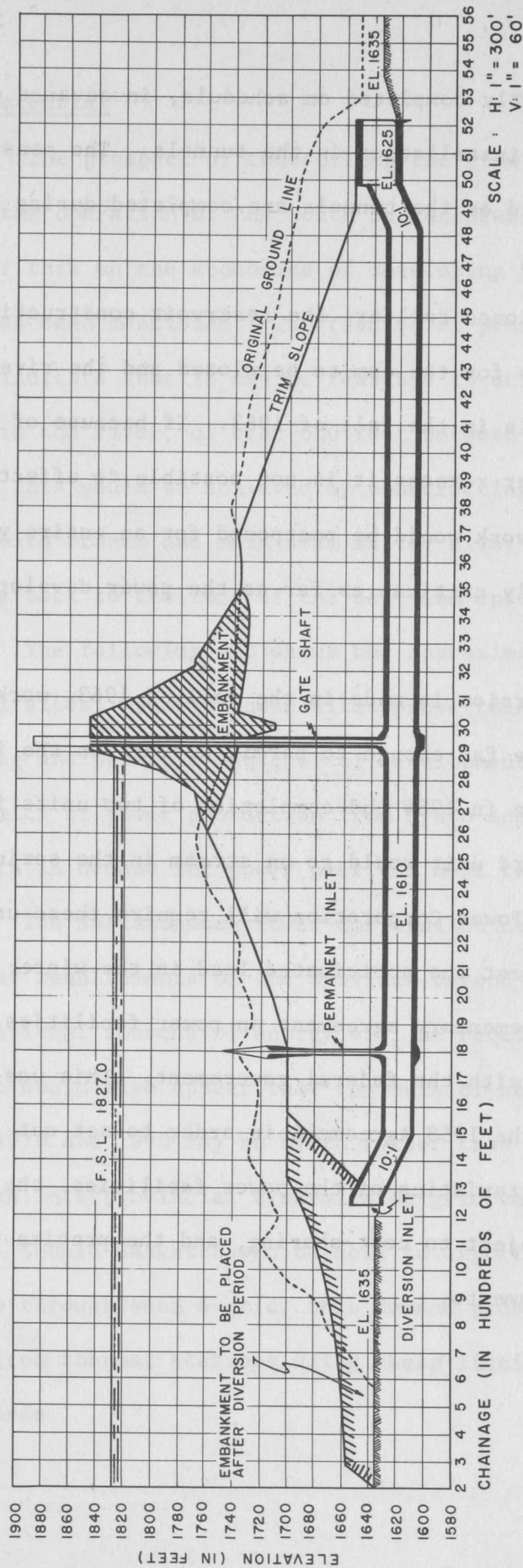
be developed in two stages. The first stage will include three turbo-generators with a combined rating of 187,500 kilowatts located at the downstream toe of the dam on the west side. They will be attached to the downstream end of three of the five diversion tunnels which will be lined with steel to serve as penstocks.

The design of the first stage will permit the installation of penstocks and turbo-generators in the remaining two tunnels at some future date, increasing the capacity of the plant to about 312,000 kilowatts. The timing of this expansion will depend on the growth in power demand and the relative economy of alternative sources of generation. Between 350 million and 1 billion kilowatt hours may be generated annually at this site, depending on river flows.

Work on the construction of the first stage began during 1961. Two contracts valued at \$2.1 million had been let in 1960. One contract was awarded to Interprovincial Steel Corporation for the supply and delivery of steel plate for penstock liner. The other went to Sparling Tank and Manufacturing Company and covered the fabrication of the steel plate into 20-foot diameter penstock sections and its delivery to P.F.R.A. for installation in the tunnels.

Sparling Tank established a fabrication plant close to the dam site late in 1960. Work began towards the end of that

EMBANKMENT AND TUNNEL PROFILE



DIVERSION TUNNEL DATA

NUMBER OF TUNNELS	5
AVERAGE LENGTH	4,050 FEET
OUTSIDE DIAMETER	25 FEET
CONCRETE LINING	2 1/2 FEET

PURPOSES

- TO DIVERT THE RIVER DURING LATER STAGES OF DAM CONSTRUCTION.
- TO CONVEY WATER FROM THE RESERVOIR TO TURBO - GENERATORS IN THE POWER HOUSE.

year and was recently completed on schedule, in advance of the date required for installation in the tunnels. The penstocks are to be installed as the tunnels are completed during 1962 and the spring of 1963.

As mentioned earlier, the reservoir construction schedule now calls for the dam to be closed and the river diverted through the tunnels in the fall of 1963. If because of flood conditions or other reasons it is not possible to effect closure at this time the work would be postponed for an entire year. This timing is extremely critical as far as the power development is concerned.

If diversion is made in the fall of 1963, work on the dam should advance far enough to permit a start on the foundations of the power house in 1964 and completion of two units in the fall of 1966. The third unit would go on stream in the spring of 1967. The Saskatchewan Power Corporation will require these units in the fall of 1966 to meet the anticipated load in the winter of 1966-67.

A supplementary agreement on power facilities is currently being negotiated with the federal government. This was called for in the terms of the 1958 Agreement in order to set out in greater detail the characteristics of the power facilities, the components that would be subject to cost-sharing, and the precise responsibilities of the two governments.

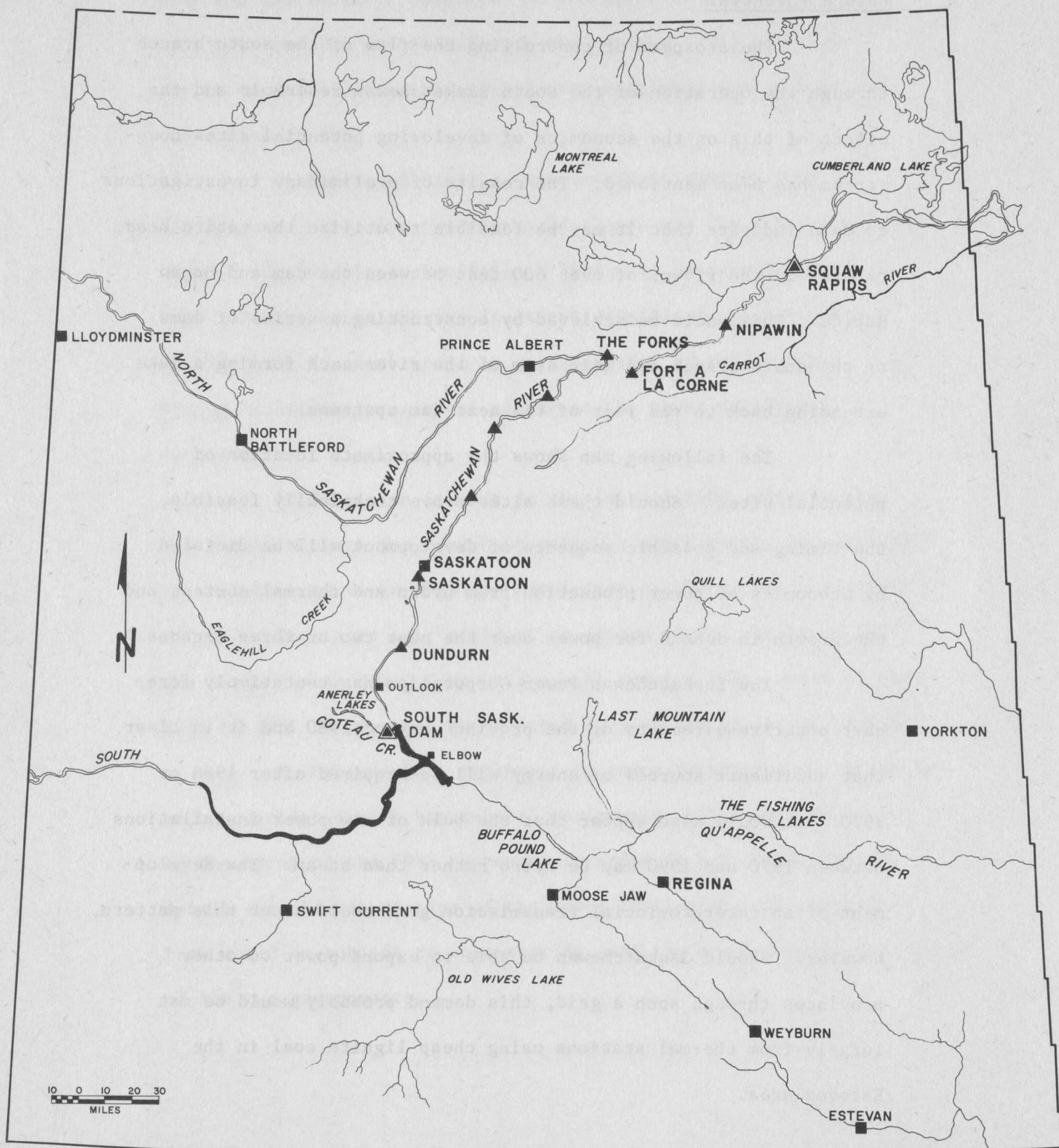
Future Potential

The prospect of controlling the flow of the south branch through the operation of the South Saskatchewan reservoir and the effect of this on the economics of developing potential sites downstream has been mentioned. The results of preliminary investigations to date indicate that it may be feasible to utilize the entire head, or drop in the river, of over 600 feet between the dam and Squaw Rapids. This would be achieved by constructing a series of dams on the south branch and main stem of the river each forming a lake extending back to the foot of the next dam upstream.

The following map shows the approximate location of potential sites. Should these sites prove technically feasible, the timing and possible sequence of development will be dictated by economics of power production from hydro and thermal sources and the growth in demand for power over the next two or three decades.

The Saskatchewan Power Corporation has tentatively forecast power requirements of the province beyond 1980 and it is clear that additional sources of energy will be required after 1968 or 1970. It would also appear that the bulk of new power installations between 1970 and 1990 may be hydro rather than steam. The development of an interprovincial transmission grid could alter this pattern, however. Should Saskatchewan be able to export power to other provinces through such a grid, this demand probably would be met largely from thermal stations using cheap lignite coal in the Estevan area.

POTENTIAL HYDRO SITES



The Next Step?

The study of future sources of new generating capacity, both hydro and thermal, will continue. Of more immediate interest are the investigations carried out this past year, and still under way, to determine the feasibility of developing a site close to the South Saskatchewan dam that, in addition to providing electrical energy, would facilitate the supply of water to irrigable areas on the west side of the river. It was felt that the provision of power, irrigation and perhaps other benefits from a single project could result in substantial overall cost savings. This is another example of the "multi-purpose" approach to water resource planning.

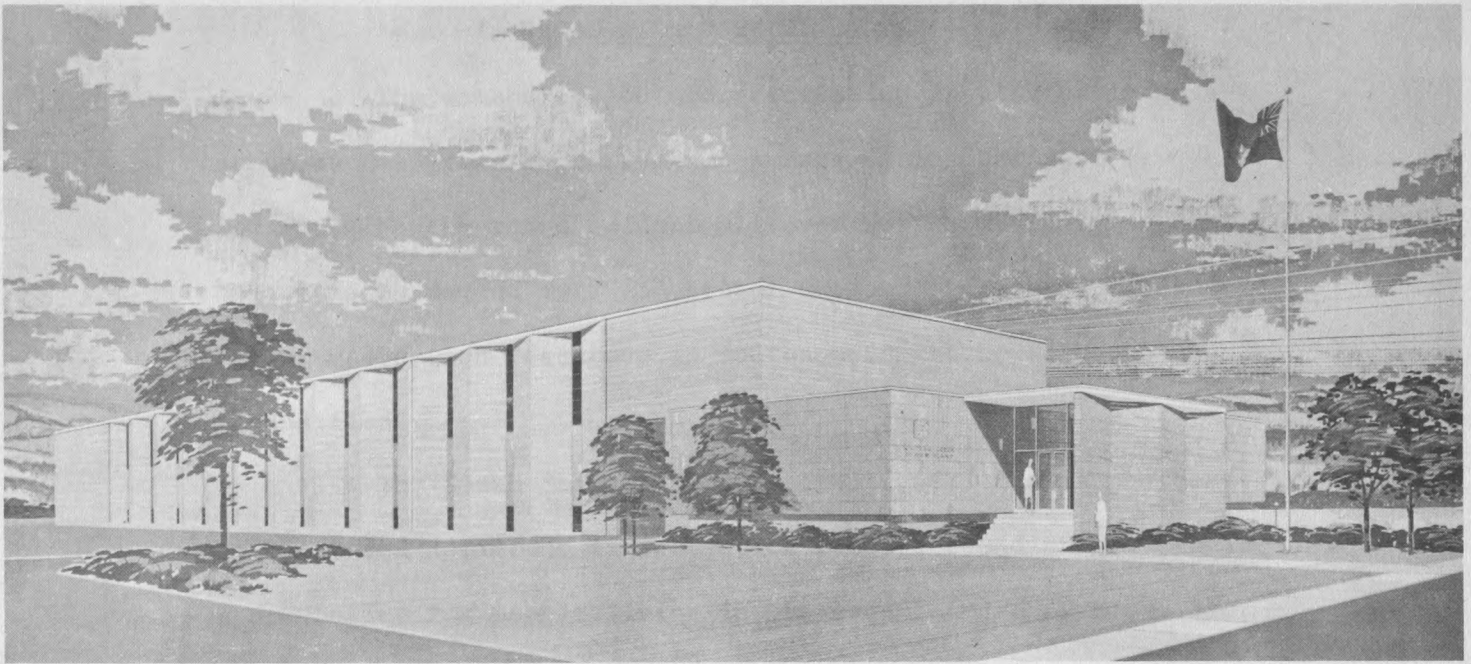
First of all, attention was focussed on the feasibility of constructing a dam on the river west of Dundurn. Such a dam would create a reservoir extending back to the foot of the South Saskatchewan dam and could provide several benefits. A power plant could be installed at the dam. Some irrigable areas on the west side of the river could be serviced from the Dundurn reservoir instead of from the South Saskatchewan reservoir. This would reduce the required length of supply canals and result in considerable cost savings. Since this water would pass through the South Saskatchewan dam before being diverted, the amount of power produced at the Coteau plant would be increased. The reservoir would be suitable for some types of recreation development. And it would serve to regulate high periodic discharges

released from the Coteau plant. This project is technically feasible and probably will be developed at some future date but the preliminary study indicated that the power produced would not be as economic, at this time, as that available from other sources.

Attention therefore, turned to another alternative that would not only provide economic generating capacity, but would also facilitate the provision of water for irrigation and, perhaps provide other benefits. As mentioned in the discussion of irrigation, the feasibility of constructing a pumped-storage project in the Anerley Lakes chain is currently being investigated.

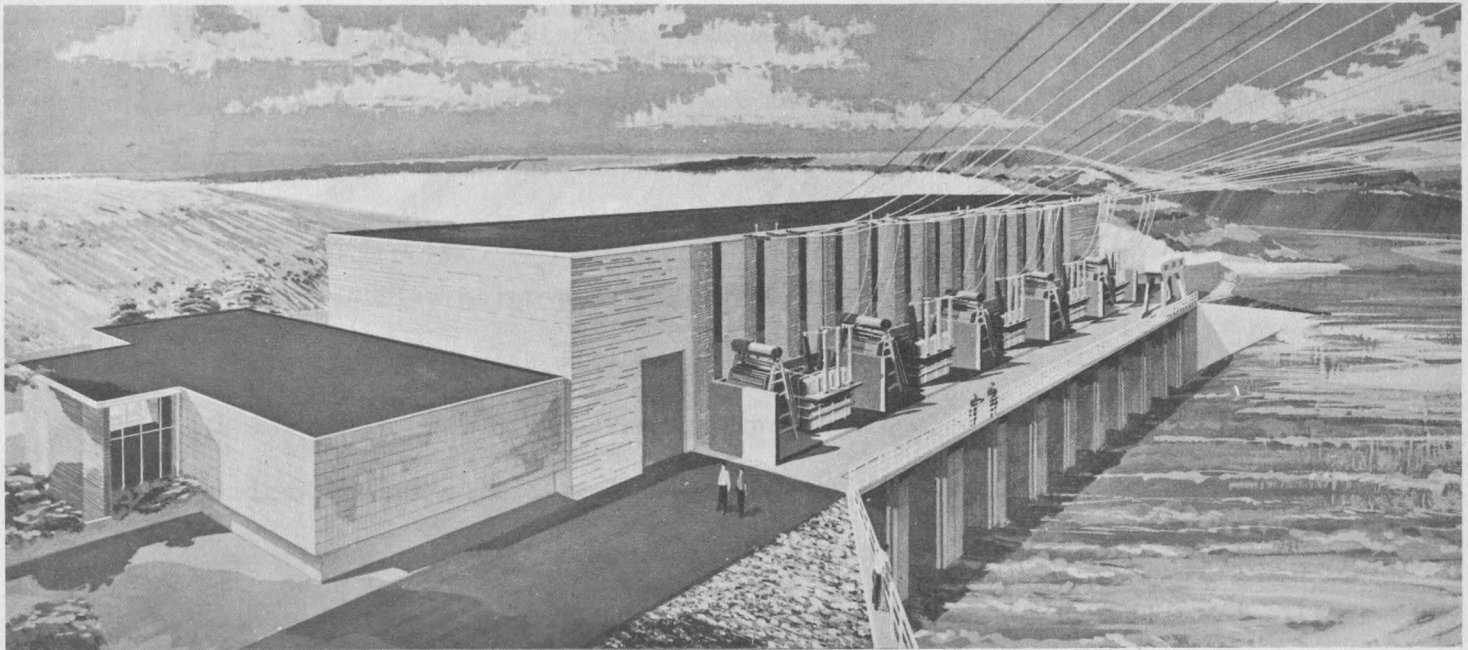
A major problem faced by most electrical utilities is how to obtain capacity, at a reasonable cost, to supply the peak-loads of their system. The establishment of pumped-storage facilities, where they can be economically fitted into the overall system, is a method of doing this. Reversible pump-turbines can do double duty serving as pumps powered by low-cost off-peak power or turbines generating power during periods of high demand. Thus, available water storage can be increased without materially increasing costs. In the case of the Anerley Lakes, the pumps could serve the additional purpose of diverting water for irrigation and the reservoir created could substitute for several miles of expensive irrigation canals.

The feasibility of this project will not be known until some time in 1962. If early development proves feasible, the plans for irrigation, power and other benefits will be co-ordinated.



Front View

Rear View



Saskatchewan Government Photographs

ARTIST'S IMPRESSION OF THE COTEAU CREEK HYDROELECTRIC PLANT
 CRIPPEN WRIGHT ENGINEERING LTD. TOBY & RUSSELL ARCHITECTS
 VANCOUVER B.C.

RECREATION DEVELOPMENT

The demand for outdoor recreation facilities in Saskatchewan has grown at a tremendous rate during the past few years in line with the trend evident all over North America. As people have come to demand more and better outdoor recreation the shortage of recreation resources in southern Saskatchewan has been intensified.

The South Saskatchewan reservoir will lie in the heart of this area deficient in recreation resources and should provide a new outlet for people living in the area bounded by Moose Jaw, Swift Current and Saskatoon, where the most serious shortage has existed in the past. Attention turned to the recreation prospects of the reservoir shortly after the 1958 Agreement was signed. Its potential remained virtually unknown, however, until the Commission appointed a recreation consultant in August, 1959, to identify and evaluate the available natural resources and to make recommendations with respect to the most desirable course of development.

Five major points emerged from the study. First, no major recreation resources will be destroyed by reservoir flooding, although a few small community parks and institutional camps will have to be relocated and redeveloped. Second, the demand for recreation facilities around the reservoir will be heavy and varied. Third, although resources will exist for a wide variety of recreation facilities, careful long-term planning and controlled develop-

ment will be necessary to realize all the benefits that the reservoir can bestow. Fourth, many parts of the reservoir shoreline will be unsuitable for recreation development because of fluctuating water levels, erosion, slumping, sedimentation and other reasons. Fifth, investigations should be made to identify the lands subject to erosion, slides and encroachment by sediment.

Relocation of Existing Facilities

Several community parks and institutional camps now located within the reservoir area will be flooded after river diversion takes place and water begins to rise behind the dam. These facilities will likely be flooded in the fall of 1963, or in the spring of 1964.

During 1961, the province and P.F.R.A. adopted a joint policy to handle the relocation of those facilities which will be affected. Under this policy the Department of Natural Resources will assist the groups concerned in the selection and planning of alternative sites. This should be done during 1962-63. P.F.R.A. will then arrange for the relocation of buildings and other facilities during the summer of 1963.

Site Selection and Development Planning

The first steps towards site selection and planning were taken with the completion of the consultant's report mentioned earlier. The consultant determined the general location of areas suitable for various types of recreation development such as

provincial parks, regional parks, institutional camp sites, cottage areas and wildlife management areas. This selection was based upon a consideration of land forms, shoreline topography and the probable regime of water levels in the reservoir during the recreation season. The probable source and volume of demand for recreation facilities was evaluated from submissions received from over forty municipalities and institutional groups. As noted, however, the consultant's recommendations were tentative and were conditional on the outcome of specialized studies to identify lands subject to erosion, slumping or sedimentation.

Early in 1961 consultants were engaged to evaluate each problem. The erosion study involved a detailed examination of the reservoir shoreline from aerial photographs, supplemented by ground checks of problem areas. The information was mapped and areas of severe, moderate and minor hazards from slumping and erosion were delineated. Thus it was possible to assess the cause and extent of future erosion and slumping problems around the reservoir shoreline. The report is now completed and is currently being evaluated.

The South Saskatchewan river carries a heavy load of sediment and most of it is now deposited in the delta region from a point west of Squaw Rapids to The Pas, Manitoba. This sediment will be trapped in the reservoir when it is completed. Most of it will be deposited near the upper end forming a large

delta which may encroach upon the shoreline. A second consultant has been engaged to forecast the rate of growth and determine the configuration of this delta. The study is now approaching its final stages and should be completed in the near future.

Development Controls

The development of recreation or any shoreline use on a multi-purpose reservoir involves complex and unique problems. Fluctuating water levels, bank instability, erosion and sedimentation are some of these. Certain areas will have to be permanently reserved for watershed protection, afforestation or low-density uses such as grazing which require few, if any, permanent structures. In all areas, structures must be designed and located so that they will not be damaged or their use impaired by fluctuating levels resulting from power and irrigation drawdowns and periodic wave and water action above the normal "full supply level" of the reservoir. The full supply level of the reservoir will be at approximately geodetic elevation 1,827 but, under certain conditions, wave and water action will occur as high as elevation 1,840. Therefore, as a general rule permanent structures should not be located below the 1,840 contour and beach facilities should be designed to accommodate fluctuations and to withstand wave and water action.

Comprehensive land use controls will therefore be necessary to guide development into those areas best suited to

the purposes in mind and to avoid damage to structures resulting from unstable banks and periodic water action. Potential conflicts in land use and between the various functions of the reservoir can be minimized by foresighted planning of the shoreline. The introduction of land use controls around the site of the South Saskatchewan dam in 1961 represented the first step in planned shoreline development. This is discussed later in the chapter on regional development.

Long-Term Planning

When a final land use plan has been prepared, areas can be reserved for the various types of recreation development and detailed site planning can begin.

Public development such as provincial parks, boat launching sites and wildlife management areas will be the responsibility of the Department of Natural Resources. Plans will be implemented over a long period of time but pre-development work should begin in the near future. Existing tree cover and scrub in selected parts of the reservoir should be cleared so that partially flooded vegetation and underwater obstacles to boating will be removed.

The shortage of good forest shade and shelter around the reservoir shoreline will be perhaps the greatest single handicap to recreation development. Plans are under way to overcome the deficiency by a long-term program of afforestation. A new provincial nursery was opened in August 1961 near Prince

Albert, which will be in a position to supply some stock in 1964 and will reach full production in 1965. The federal forest nurseries at Indian Head and Sutherland as well as private nurseries might be other sources of stock should the need arise.

The layout of parks, boat launching areas and other public facilities will be planned well in advance of the time when these facilities will first be needed. Implementation of the program will then continue over a number of years. The rate of development will be governed partly by such physical limitations as the speed with which shade trees can be established and the time that it takes for beaches to form, and partly by the staff and funds available to the Department of Natural Resources. It is hoped that at least minimum facilities will be available in public recreation areas to accommodate the demand expected when the reservoir is filled.

Policy has not yet been finalized respecting areas to be reserved for development by other groups such as municipalities, regional park bodies and institutional organizations. It is expected that the development of these areas will proceed along similar lines since they will be subject to essentially the same limitations.

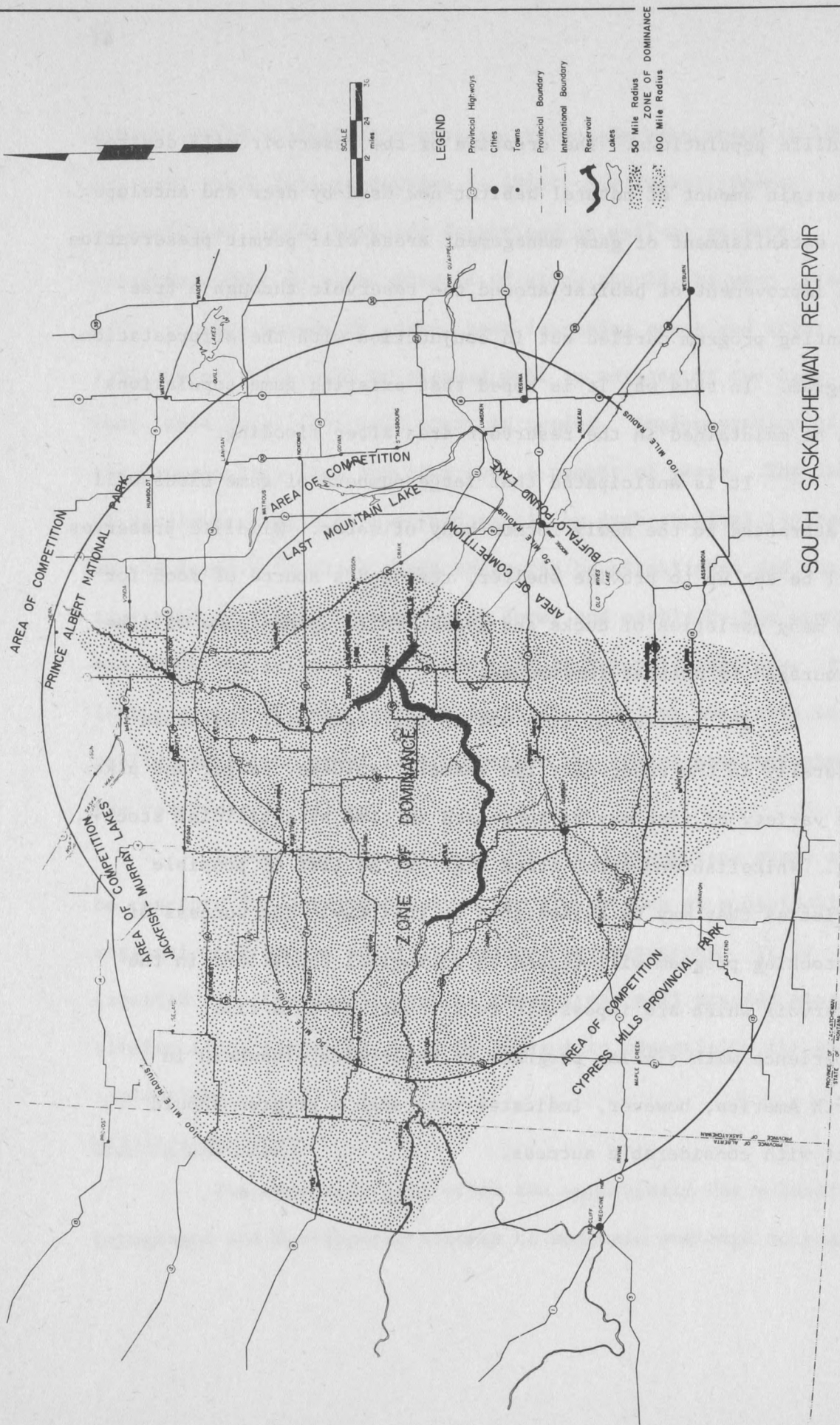
Wildlife and Fish

The reservoir will offer the opportunity for wildlife management and development schemes to maintain and even increase

wildlife populations. The creation of the reservoir will destroy a certain amount of natural habitat now used by deer and antelope. The establishment of game management areas will permit preservation and improvement of habitat around the reservoir through a tree-planting program carried out in conjunction with the afforestation program. In this way it is hoped that existing game populations can be maintained in the reservoir area after flooding.

It is anticipated that large numbers of game birds will be attracted to the newly-formed body of water. Wildlife preserves will be set up to provide shelter, rest and a source of food for the many varieties of ducks and geese, while upland game will be encouraged by habitat improvement.

The species of fish now in the river will reproduce naturally in the reservoir; for example, goldeye, sauger and pike. The variety of fish may be increased in time by artificial stocking. Whitefish and trout stand high on the list of possible varieties that may be established in this way. The success of a stocking program will depend on biological conditions in the reservoir which are impossible to forecast at this time. Experience with similar programs on reservoirs elsewhere in North America, however, indicates that such a program should meet with considerable success.



SOUTH SASKATCHEWAN RESERVOIR AREA TO BE SERVED BY RECREATION DEVELOPMENT

RESERVOIR OPERATION

Under its Act the Commission was given jurisdiction over the operational management of the reservoir with the objective of achieving the best use of river flows and available storage. This responsibility entails the preparation of regulations to govern the operation of the reservoir.

Experience elsewhere indicates that the preparation of regulations for the operation of a multi-purpose reservoir of this kind will be a complex and time-consuming task. During the past year, work has gone ahead in three main areas. First, studies are being carried out to test and narrow down possible alternative methods of operation. Second, the requirements for an adequate stream flow forecasting system are being evaluated. Third, the Commission has made a number of studies to guide agencies in their current planning and design of the project.

Several factors tend to complicate the operation of a reservoir of this kind. The huge storage capacity of the reservoir is to be used for several primary functions of the project such as power and irrigation as well as a number of secondary functions like recreation and diversion into the Qu'Appelle basin. An operating schedule designed to maximize the benefits from one function, say power, may be in serious conflict with another function, for example, recreation. Hence, in attempting to optimize the total benefits from all functions, compromise is

necessary. Then, too, this is only one of several reservoirs in existence or planned on the Saskatchewan river system. Its operation will be influenced by and should be integrated with the operation of these other reservoirs and with reservoirs in the Qu'Appelle system.

The second major area of study has been to outline the requirements for an adequate stream-flow forecasting system. The importance of this cannot be over-emphasized. The earlier flows can be anticipated with a reasonable degree of accuracy, the more efficiently the reservoir may be operated. If watershed conditions indicate a drought, storage should be maintained at a maximum so that established services may function throughout a low flow period. If high flows are indicated, the reservoir may be drawn down to accommodate the expected inflow. Failure or inability to forecast can result either in water shortages during an unexpected low-flow period or excess spillage during a high-flow period with a consequent loss in potential power revenue.

A few years ago the United States Corps of Engineers and Weather Bureau made an analysis of the benefits and costs of a comprehensive forecasting program in the Missouri Basin. This study indicated that the ratio of benefits to costs would be of the order of 30 to 1. The larger number of reservoirs on the Missouri result in a ratio greater than would be expected on the Saskatchewan system; at least until further development occurs.

Nevertheless, the benefits from forecasting should far outweigh the costs.

As a first step towards a forecasting system, the Commission has started a study of the existing programs of federal and provincial agencies to collect hydrometric, meteorological, snow and other data basic to a stream flow forecast. The existing program is inadequate and out of this study should come recommendations for additional data collection stations at different points in the basin. Following this study, the Commission expects to complete an evaluation of the benefits and costs of expanding the existing network, similar to the one referred to above.

During the past year, the Commission carried out several studies to guide other agencies in planning the various phases of the project. An example of this is a study, completed late in 1961, to determine the capacity of the outlet works required in the Qu'Appelle dam. This involved an assessment of existing and future water supply and demand in the Qu'Appelle basin. The demand for surface water from the Qu'Appelle for all purposes was forecast to the year 2000. Operation studies were run to determine the extent to which this demand could be met by natural flows and the amount of water that would have to be drawn from the South Saskatchewan.

The Commission was assisted in this study by several

provincial agencies, P.F.R.A. and the cities of Regina and Moose Jaw. This study indicated that, in an average year, only 45% of the existing demand for all uses and about 35% of the future demand could be satisfied by natural runoff. The rest would have to be obtained from the South Saskatchewan. The Assiniboine basin is also a water deficient area and the Province of Manitoba has indicated that it may wish to import some water from the South Saskatchewan to the Assiniboine via the Qu'Appelle. This study will serve to guide a decision on the capacity and other characteristics of the outlet works to be installed in the Qu'Appelle dam.

REGIONAL DEVELOPMENT

During the past three years, project construction has resulted in changes in the use of land near the site of the South Saskatchewan dam and in several villages and towns within a radius of about 25 miles from the dam. When the project is completed, significant changes can be expected within a more extensive geographic area surrounding the reservoir. The new resource complex of water, irrigable land and power, will create opportunities for various types of development, ranging from parks to industry. Focal points for new development will probably be certain urban centers and preferred stretches of the reservoir shoreline. The fact that dynamic growth can be predicted well in advance, even though much of it cannot yet be pinpointed by type or place, suggests the need to proceed now with long-term planning and the introduction of appropriate controls to guide this growth so that well-balanced regional development will be achieved.

The Commission has legislative powers which enable it to influence development in the region both directly and indirectly. It is responsible for ensuring that adequate land use controls are enacted and enforced by local municipalities in a "construction area" comprising six rural municipalities and the towns and villages within their boundaries. The Commission is also charged with protection and development of the reservoir periphery. These responsibilities are discharged in different ways.

Zoning by-laws are in effect in several rural and urban municipalities near the South Saskatchewan dam. These were initially introduced in 1959 by local councils as interim zoning by-laws, prepared by the Community Planning Branch of the Department of Municipal Affairs. The objective at that time was to prevent haphazard ribbon development along highways and access routes to the project and to direct development into existing urban centers or to a few selected areas for commercial and industrial services.

Later, the Commission, in co-operation with the branch, prepared a series of studies dealing with population trends in the region during the construction period and the effects of population changes on land use needs. This analysis of the probable influence of the project on regional population and land use was discussed with municipal councils and led to revisions of the zoning by-laws in 1960 so that they would serve satisfactorily during the construction period. The local zoning by-laws have proved to be a useful tool in guiding development in the project region.

Planning and protection of the reservoir periphery are carried out at the provincial level by the Commission. The objectives of the enabling legislation are to ensure that land adjacent to the reservoir is developed in a safe and orderly manner; that potential damage to buildings or structures due to

flooding, water action, slumping or sedimentation will be minimized; and that shoreline development will not interfere with the efficient operation of the reservoir. To achieve these objectives, the Commission may make regulations designating a reservoir development area and controlling within it the use of land and the erection or improvement of buildings.

Reservoir development area regulations were first introduced in June 1961 in an area comprising the four townships immediately surrounding the South Saskatchewan dam. The regulations were advertised locally and considered at a public hearing at the dam site prior to formal approval. Six types of land use districts were established to provide for construction work, commercial and industrial services and agricultural uses. In general, any person wishing to undertake development for a purpose other than agriculture must apply to the Commission for a development permit.

The Commission expects to extend the reservoir development area during 1962, to cover the balance of the reservoir shoreline, including the area around the site of the Qu'Appelle dam. Initially, the regulations will permit agricultural uses only, except in the general vicinity of the two dams where other types of land use districts will be necessary to provide for uses associated with the construction activity. There will also be strict development control in those areas which have been

identified by special studies as subject to flooding, water action, slumping or encroachment by sedimentation.

The regulations will be amended periodically as further studies of the physical characteristics of the reservoir area are completed and as the needs for recreation, commercial, industrial and other development can be determined. The effects of the creation of this great new water resource can then be stated in terms of land needs; suitable lands can be selected for various purposes; and regulations can be redrafted in an appropriate form.

ECONOMIC IMPACT OF CONSTRUCTION

The physical changes being fashioned by dam construction are solid evidence of the investment in land labour and capital occasioned by the South Saskatchewan project. Less visible, but no less important, is the impact that this work has had on the economy of the region and throughout the province. While it is impossible to measure this impact precisely, it can be traced to some extent through changes in population, employment, purchasing power and personal and public expenditures.

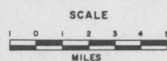
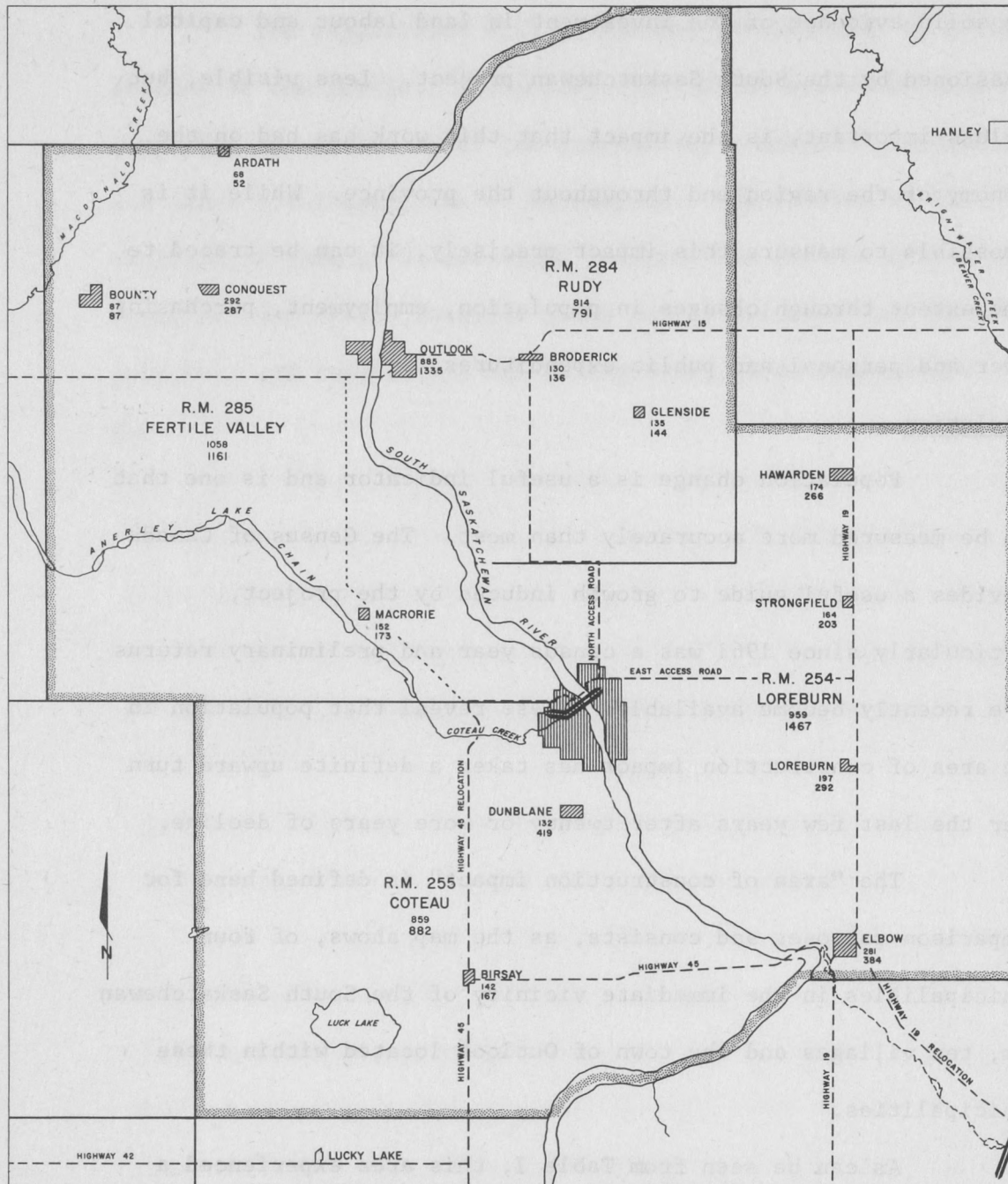
Population

Population change is a useful indicator and is one that can be measured more accurately than most. The Census of Canada provides a useful guide to growth induced by the project, particularly since 1961 was a census year and preliminary returns have recently become available. These reveal that population in the area of construction impact has taken a definite upward turn over the last few years after twenty or more years of decline.

The "area of construction impact" is defined here for comparison purposes and consists, as the map shows, of four municipalities in the immediate vicinity of the South Saskatchewan dam, ten villages and the town of Outlook located within these municipalities.

As can be seen from Table I, this area experienced a decline in population from 10,664 to 6,257 between 1921 and 1951.

CONSTRUCTION AREA SOUTH SASKATCHEWAN RIVER DAM



TOWNS AND VILLAGES
 100 POPULATION, CENSUS 1956
 120 POPULATION, CENSUS 1961
 R.F.R.A. RESTRICTED AREA

DAMS
 ROADS (TO BE CONSTRUCTED, 1962 - - - -)
 BOUNDARIES OF RURAL MUNICIPALITIES
 CONSTRUCTION AREA

This trend now appears to have been reversed in urban municipalities. In rural municipalities the increase from 1956 to 1961 is due largely to project employees at or near the dam site, so must be interpreted as a temporary condition rather than a change in trend.

Population grew a mere 2% from 1951 to 1956 when it stood at 6,374, but leapt 27% between 1956 and 1961 and now stands at 8,107, an increase of 1,733 over 1956. A major part of this gain was concentrated in the urban sector. The urban increase amounted to 1,122 people between 1956 and 1961, of which the town of Outlook alone accounted for 450 persons. Most of the rural increase of 611 was in the R. M. of Loreburn which had 508 more people in 1961 than in 1956. This was due in large part to the establishment of the P.F.R.A. project headquarters in the municipality and to the influx of workers employed on the project.

Table I

POPULATION OF CONSTRUCTION AREA 1921 - 1961

<u>Population</u>	<u>1921</u>	<u>1931</u>	<u>1941</u>	<u>1951</u>	<u>1956</u>	<u>1961*</u>
Towns and Villages	2,458	2,600	1,933	2,274	2,684	3,806
Rural Municipalities	<u>8,206</u>	<u>8,272</u>	<u>5,757</u>	<u>3,983</u>	<u>3,690</u>	<u>4,301</u>
Total	10,664	10,872	7,690	6,257	6,374	8,107
<u>Percentage Changes</u>	<u>10-Year Periods</u>			<u>5-Year Periods</u>		
	<u>1931/21</u>	<u>1941/31</u>	<u>1951/41</u>	<u>1961/51</u>	<u>1956/51</u>	<u>1961/56</u>
Towns and Villages	+ 6	- 26	+ 18	+ 68	+ 18	+ 42
Rural Municipalities	<u>+ 1</u>	<u>- 30</u>	<u>- 31</u>	<u>+ 8</u>	<u>- 7</u>	<u>+ 17</u>
Total	+ 2	- 29	- 19	+ 29	+ 2	+ 27

* Preliminary

Source: Census of Canada

A comparison with surrounding municipalities, towns, and villages indicates that while the population in the area of construction impact has been increasing rapidly, the surrounding population showed no gain. It may therefore be concluded that, without the project, the population of this area would have remained at or about the 1956 figure of 6,374 persons.

On this basis the population increase induced by the project to date measures about 1,800 persons. This is made up partly of construction employees and their families who have moved into the area and partly of those families attracted to the area by increased opportunities for commercial activity. This figure under-estimates the change since it does not include employees living at or near the site at the time of the census, whose permanent residence was elsewhere. Thus a number of single employees living in the contractors' camps would not have been enumerated.

Employment

Employment to date on the project is recorded in Table II. Between 1958 and 1961 the number employed on construction has varied from season to season and, indeed, from week to week as the needs of the various contractors have changed. Employment is higher in summer than winter, mostly because embankment contracts require control over moisture content and compaction of materials. This can be achieved only during the frost-free

season. The decrease was relatively less during the winter of 1960-61 than in earlier years since the tunnelling contracts involve considerable work underground and can proceed with less concern for the weather.

Table II

PROJECT EMPLOYMENT

	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>
1958-59	75	0	37
1959-60	400	250	325
1960-61			
Summer *	870	-	-
Winter	622	469	545
1961			
Summer	1,280	560	922

* Summer; May to October, inclusive.
Source P.F.R.A.

Estimated project employment contained in Table III shows that employment during the summer of 1961 of 1,280 is just a little short of the forecasted peak, expected in the summer of 1962. According to this forecast, employment should remain at about current levels until 1964-65 when it will show a slight decline. It may recover in 1965-66 due to work associated with construction of the power house. Current estimates show a rapid drop in employment in 1966, but the forecast does not include employment associated with the construction of the irrigation system. This may help to maintain employment at a somewhat higher level than shown after 1966.

Table III

EMPLOYMENT ESTIMATES 1/RESERVOIR AND POWER PLANT CONSTRUCTION

	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>
1961-62			
Summer ^{2/}	1,280	560	922
Winter	750	600	675
1962-63			
Summer	1,300	800	1,050
Winter	750	600	675
1963-64			
Summer ^{3/}	1,200	600	800
Winter	600	350	475
1964-65			
Summer	1,000	540	770
Winter	465 ^{4/}	- ^{5/}	355
1965-66			
Summer	1,300	-	170
Winter	590	-	440
1966-67			
Summer	250	-	170
Winter	45	-	30
1967-68			
Summer	35	-	30

Sources: P.F.R.A. estimates November, 1961

S.P.C. estimates Revised December, 1961

^{1/} Irrigation estimates not available.^{2/} Summer; May to October: Winter; November to April, inclusive.^{3/} Estimates from 1963 to 1965 include Qu'Appelle dam.^{4/} Power plant construction included from November 1, 1964.^{5/} Minimum estimates not available 1964 to 1968.

The population increase resulting from direct employment at the site generates further additions to the population as new businesses are established or existing ones enlarged to meet the increased demand. Although this indirect increase is difficult to estimate, a figure has been deduced from the employment and census figures. It assumes that 25% of construction employees are local men who lived and worked in the construction area prior to the start of the project and that the proportion of employees living in construction camps is about half of total employees.

Given these assumptions, the direct increase in population at June 1, 1961 would have been about 700 persons and the indirect increase about 1,100, for a total increase of about 1,800. Assuming further an average family size of 4 persons, (the Saskatchewan average is 3.9) this suggests that off-site employment opportunities had been created for between 250 and 300 persons by the summer of 1961.

Clearly the business resulting from construction will vary seasonally with the level of construction activity and employment. Employment associated with this business will also vary seasonally but to a lesser degree. Since estimates of future employment at the site indicate levels similar to those in 1961-62, indirect employment may not increase greatly over 1961 levels. However, commercial

activity rarely adjusts immediately to increased opportunities so there may still be changes in the indirect employment picture.

New Purchasing Power

Between 1958 and the end of 1961, \$36 million has been expended on the project; \$32.6 million on the dam, \$2.3 million on power, \$0.85 million on irrigation, and \$0.3 million on other purposes. In addition, considerable sums have been spent by private sources for the establishment of new and expansion of existing businesses. These expenditures have injected new purchasing power into the economy not only of the local area but also the province as a whole. An attempt has been made to break down expenditures on dam construction, but it should be emphasized that such a breakdown is most difficult to make with any degree of accuracy.

Wages and salaries account for roughly 17% of expenditures on dam construction to date. It is estimated that between the start of the project and the summer of 1961 more than \$6 million had been paid in wages and salaries. This figure is probably under-estimated because it does not take into account overtime work for which there are no records. By 1968 total outlays on wages and salaries may exceed \$19.5 million provided the composition of the labour force is similar to that of 1961. If it is, then \$5 to \$6 million of this total

will go to employees resident in the area prior to the start of the project.

It is also estimated that to the end of 1961 about \$6.6 million was spent on materials used in construction, of which \$1.6 million was spent in Saskatchewan. Replacement value of equipment used so far is estimated at about \$15.7 million, of which \$7.8 million was purchased in Saskatchewan. The servicing of equipment in terms of labour, repairs, fuel transport, and spare parts is valued at \$5 million all of which was spent in Saskatchewan, mostly in the local area of the dam. Thus almost 53% of the total expenditure on materials -- about \$14.4 million has been spent in the province.

Retail Trade

Since 1957, the increase in retail trade has been much greater in the area of construction impact than in the province as a whole. Judging from taxation statistics, retail sales in the area increased by about 50% or around \$2 million between 1957 and 1960. This estimate is conservative in that it does not include such major items as bulk oil, beer and liquor. By comparison, figures published by the Dominion Bureau of Statistics show that during the same period retail sales in the province as a whole increased 10% from \$854.8 million to \$937.1 million.

Within the area, the greatest increase in retail trade occurred in Outlook which accounted for nearly one-half

of the total increase from 1957 to 1960. The village of Dunblane showed the greatest percentage gain, tripling its business during the same period. Other centers in the area recorded gains of 10% to 50%, roughly proportionate to their increase in population.

New Investment

Since the project started, more than forty new commercial enterprises have been established in the area, representing an investment of at least \$800,000. The value of new commercial construction during 1961 is estimated at roughly \$300,000. This includes motels, trailer courts, garages and a variety of retail outlets. New construction in the public sector during 1961 was about \$470,000. Two very large expenditures -- a hospital extension at Outlook and a new school at Loreburn -- accounted for the major part of the total.

It is probable that new investment in all types of buildings, commercial, public and residential during 1961 approached the \$1 million mark. Many communities shared in this growth although the town of Outlook has benefited more than any other.

Conclusions

The economic changes induced by the project cannot be clearly separated from those that may have occurred without

the project. It is clear, however, that economic activity in the area, which was showing little evidence of growth prior to 1958, has since expanded considerably. Now that the reservoir has been under construction for more than three years, the physical, economic and social changes which it is generating are becoming more apparent. As work progresses, these changes will extend over a wider area and will affect a growing number of people.

Capital	28,150	215,375
Ordinary	170,897	139,582
Other (Bank, Water Corp.)		
Ordinary	16,000	5,121
Recreation		
Capital (Dept. of Nat. Res.)		4,720
Capital (Dept. of Ind. & Min.)	14,340	
Ordinary (S.S.R.B.C.)	15,482	4,289
Co-ordination (S.S.R.B.C.)		
Ordinary	37,300	65,081
Other (Highway relocation)		
Ordinary (Dept. of Highways)		21,542
	<u>\$ 422,248</u>	<u>\$ 1,210,928</u>

Includes Saskatchewan share of F.F.S.R. expenditures and Saskatchewan share of Saskatchewan expenditures on main reservoir construction.

Includes only direct expenditures associated with the project and does not include some minor expenditures on the sale of power, government administration and overhead which would be difficult or impossible to segregate.

These expenditures are on calendar year basis.

Appendix I

PROVINCIAL EXPENDITURE ON THE SOUTH SASKATCHEWAN PROJECT

	<u>1959-60</u>	<u>1960-61</u>
<u>Shareable Items</u>		
Reservoir Construction ^{1/}		
1. Dept. of Agric.	\$ 62,492	\$ 563,387
2. Sask. Power Corp.	62,492	563,387
<u>Non-Shareable Items</u> ^{2/}		
Irrigation (Dept. of Agric.)		
Capital	18,130	215,379
Ordinary	170,697	155,682
Power (Sask. Power Corp.) ^{3/}		
Ordinary	76,000	5,477
Recreation		
Capital (Dept. of Nat Res.)	-	9,100
Capital (Dept. of Ind. & Infm.)	14,340	-
Ordinary (S.S.R.D.C.)	16,497	4,889
Co-ordination (S.S.R.D.C.)		
Ordinary	32,300	68,082
Other (highway relocation)		
Ordinary (Dept. of Highways)	-	25,542
	\$ <u>452,948</u>	\$ <u>1,610,925</u>

^{1/} Includes Saskatchewan share of P.F.R.A. expenditures and Saskatchewan share of Saskatchewan expenditures on main reservoir construction.

^{2/} Includes only direct expenditures associated with the project and does not include some minor expenditures or pro-rata share of general government administration and overhead which would be difficult or impossible to segregate.

^{3/} These expenditures are on calendar year basis.

APPENDIX II

CONTRACTS AWARDED ON SOUTH SASKATCHEWAN PROJECT TO DECEMBER 31, 1961

A. CONTRACTS AWARDED BY P.F.R.A.: Shareable Canada 75% and Saskatchewan 25%

<u>Contract</u>	<u>Contractor</u>	<u>Contract Price</u>	<u>Description</u>	<u>Progress to Date</u>
<u>I. Site Establishment</u>				
# 1 East Access Road	Evans Const. Co., Saskatoon	\$ 164,330.63	Approximately 13 miles of grading and gravelling for a road connecting the main dam construction site with #19 north of Loreburn.	Started September, 1958 and completed December, 1958.
# 7 North Access Road	Taylor Bros., Regina	143,479.49	Grading and gravelling of approximately 15 miles of access highway from the construction site to a point 2 miles south of Broderick.	Started May, 1959 and completed December, 1959.
# 3 Headquarters Services	Beattie Ramsay Co., Regina	242,236.56	Sewer and water services and street grading and curbing.	Started November, 1958 and completed Spring, 1959.
# 4 Construction Headquarters Buildings	Smith Bros. and Wilson, Regina	736,494.39	Construction of 38 dwelling units, staff house, administration and other buildings to house P.F.R.A. on-site staff.	Started January, 1959 and completed late 1959.
#10 Well-point System	Beattie Ramsay Co., Regina	23,392.00	Includes the sending of well-points near the edge of the river to provide a water supply for the construction headquarters and contractors camps on east side of river.	Started and completed May, 1959.
#11 Pumps	Fairbanks Morse Co., Regina	12,026.00	Purchase of pumps for construction headquarters water system.	Installed December, 1959.
# 5 Construction Bridge Substructure	Foundation Co. of Canada, Calgary	314,949.42	Piers and abutments for bridge across the South Saskatchewan River at site of main dam.	Started November, 1958 and completed May, 1959.
# 8 Construction Bridge Superstructure	Bird Const. Co., Regina	1,044,168.38	Includes the steel superstructure, railing and decking for the construction bridge.	Started June, 1959 and completed July, 1960.
#12 Tourist Pavilion	Bird Const. Co., Regina	20,771.00	Construction of a pavilion to house model and displays for sightseers.	Started September, 1959 and completed May, 1960.
Total for Site Establishment		<u>\$ 2,601,847.87</u>		

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<u>II. Embankment</u>				
# 6 East Embankment - Stage I	Perini Ltd., Toronto	\$ 2,990,919.61	Consists of 7.5 million cubic yards of excavation and the placing of 5.8 million yards of compacted earth fill on east side of river. This contract will complete the embankment on the east bank of river to about one-half the full height of the dam.	Started in the Spring of 1959 and completed October, 1960.
# 9 West Embankment - Stage II	Piggott Const. Co., Saskatoon	8,395,957.50	Includes 18 million cubic yards of excavation and 14 million cubic yards of compacted embankment. This embankment will extend from the west wall of the river slightly more than half-way across the valley. It will raise the embankment to about one-half final height.	Started in July, 1959 and is virtually complete on schedule.
#13 West Embankment - Stage III	Bedford Const. Co. Ltd., Rexdale, Ont.	8,297,950.00	Calls for movement of approximately 26 million yards of material and covers excavation of the spillway area and the completion of embankment in the Coteau Creek area to one-half final height.	Contract let March, 1961 for completion in June, 1963. Excellent progress made to date.
#19 Relief Wells and Drainage Conduit - Stage I	Piggott Const. Co., Saskatoon	207,625.26	Involves the drilling of a number of wells in the downstream toe of the dam to allow for controlled flow of seepage together with the construction of a concrete conduit to allow drainage from and access to the wells.	Started in August, 1960 and completed in June, 1961 ahead of schedule.
Total for Embankment		<u>\$19,892,452.37</u>		
<u>III. Tunnels</u>				
# 2 Processing Aggregate	McNamara Const. Ltd., Edmonton	\$ 868,681.12	Involves the stripping of the stockpile area and the processing of approximately 700,000 tons of four sizes of concrete aggregate. Some of this aggregate was used for site establishment and embankment.	Contract let in September, 1958. This contractor had production problems and did not complete work on October 31, 1959 as scheduled. Although contract was completed one year behind schedule, the delay did not affect the overall construction schedule.

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#22 Processing Aggregate	McNamara Const., Ltd., Edmonton	\$ 1,693,750.00	Processing and stockpiling of 816,000 tons of aggregate and filter material.	Contract let in May, 1961 for completion by July, 1962.
#14 Downstream Tunnels	Keiwi-Johnson-Poole Const. Cos., Vancouver	8,064,175.00*	Includes the excavation of the downstream half of the five 4,000-foot long diversion tunnels through the west bank of the river. It also includes placing the steel support beams, lining the tunnels with reinforced concrete and installing steel penstock liners in tunnel #'s 1, 2 and 3 and partial liners (40' long) in tunnel #'s 4 and 5.	Awarded in July, 1960. Slated for completion by December 31, 1962. Progress was disappointing until mid-1961 when technical difficulties encountered with mining machine "mole" were overcome.
#21 Upstream Tunnels	Keiwi-Johnson-Poole Const. Cos., Vancouver	8,658,500.00	Excavation of the upstream half of the five diversion tunnels. Includes placing of steel support beams and lining the tunnels with reinforced concrete and the excavation and installation of high level inlet structures.	Awarded April, 1961 for completion by late 1963 to the extent necessary to permit diversion of river in fall of 1963. Progress on construction of low level inlet portals and excavation and lining of high level inlet shafts have been satisfactory.
#25 Control Shaft Substructures	Keiwi-Johnson-Poole Const. Cos., Vancouver	4,903,750.00	Excavation and construction of substructure of control shafts for the five diversion tunnels.	Awarded in October, 1961.
#15 Supply of Steel Ring Beams	Commercial Shearing and Stamping Co., Hamilton	2,637,250.00	Includes the supply, fabrication and delivery of 5,500 steel ring beams involving 9,000 tons of steel and 22,000 segments.	Awarded in December, 1959 and completed in August, 1960.
#18 Supply of Cement	Canada Cement Co. Ltd., Montreal	117,008.48	Involves the supply of 17,000 barrels of sulphate-resistant cement to be delivered between August, 1960 and February, 1961 at the call of the tunnel contractor.	Awarded in July, 1960.
#24 Supply of Cement	Canada Cement Co. Ltd., and Inland Cement Co. Ltd.	3,111,750.00**	Supply of 50,000 barrels of sulphate-resistant cement to be delivered over period February 1961 to December 1962 at call of tunnel contractor.	Awarded in February, 1961.

Total for Tunnels

\$30,054,864.60

* A small portion of the work done under contract #14 is shareable 25% by Canada and 75% by Saskatchewan.

** Originally awarded Canada Cement Co. Ltd. \$412,500 and Inland Cement Co. Ltd. \$618,750. Contract extended from supply of cement for contract #14 to supply for contract #'s 14, 21 and 25.

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<u>IV. Highway Relocation</u>				
#16 Revision of Highway #45	Pederson & Co., Swift Current	\$ 118,664.91	Construction of 15.1 miles of highway from Birsay north to Tichfield and east to the dam site.	Awarded in November, 1959 and completed in August, 1960.
#17 Revision of Highway #19	Acorn Const. Co., Rivers	256,105.00	Construction of 25.5 miles of highway from #42 Highway to Elbow crossing the Qu'Appelle Valley near the Qu'Appelle Valley dam.	Awarded in May, 1960 and completed in July, 1961.
#26 Revision of Highway #45	Sanderson and Elgert, Regina	140,003.00	Construction of 16.9 miles of highway revision from Tichfield to Highway #15.	Awarded in November, 1961 for completion in 1962.
#20 Graveling of Highway #45 Revision	W. F. Bodkin Const. Ltd., Regina	14,208.84	Graveling of #45 revision Birsay to South Saskatchewan River dam site.	This work was completed in December, 1960.
#23 Graveling of Highway #19 Revision	Nick Linden Const., Medicine Hat	35,405.35	Graveling of Highway #19 revision from #42 Highway to Elbow.	This contract was let in December, 1960 and completed in August, 1961.
Total for Highway Revision		\$ 564,387.10		
Total Value of Contracts Awarded by P.F.R.A. to December 31, 1961		\$53,113,551.94		
<u>B. CONTRACTS AWARDED BY SASKATCHEWAN POWER CORPORATION: Shareable Canada 25% and Saskatchewan 75%</u>				
Supply of Steel Plate for Tunnel Liner	Interprovincial Steel Corp., Regina	\$ 988,200.00	Delivery of 6,100 tons of steel plate for fabrication into tunnel liner.	Commenced late in 1960 and completed in 1961.
Fabrication and Delivery of Tunnel Liner	Sparling Tank and Manufacturing Co., Toronto	1,119,062.72	Fabrication of approximately 6,000 feet of 20-foot diameter steel tunnel liner and delivery to dam site for installation.	Completed late in 1961.
Total Value of Contracts Awarded by S.P.C. to December 31, 1961		\$ 2,107,262.72		
Total Value of Contracts Awarded to December 31, 1961		\$55,220,814.66		

